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BULLETIN NO. 30

168

U. S. DEPARTMENT OF AGRICULTURE

OFFICE OF EXPERIMENT STATIONS

PROCEEDINGS

OF THE

NINTH ANNUAL CONVENTION

OF THE ASSOCIATION OF

American Agricultural Colleges and Experiment Stations

HELD AT

DENVER, COLORADO, JULY 16-18, 1895

EDITED BY

A. C. TRUE, for the Office of Experiment Stations

AND

H. H. GOODELL, for the Executive Committee of the Association

1862 1889

WASHINGTON
GOVERNMENT PRINTING OFFICE
1896

U. S. DEPARTMENT OF AGRICULTURE.

Scientific Bureans and Divisions.

Weather Bureau—Willis L. Moore, *Chief.*
Bureau of Animal Industry—D. E. Salmon, *Chief.*
Division of Statistics—H. A. Robinson, *Statistician.*
Division of Entomology—L. O. Howard, *Entomologist.*
Division of Chemistry—H. W. Wiley, *Chemist.*
Division of Botany—F. V. Coville, *Botanist.*
Division of Forestry—B. E. Fernow, *Chief.*
Division of Ornithology and Mammalogy—C. Hart Merriam, *Ornithologist.*
Division of Pomology—S. B. Heiges, *Pomologist.*
Division of Vegetable Physiology and Pathology—B. T. Galloway, *Chief.*
Division of Agricultural Soils—M. Whitney, *Chief.*
Division of Agrostology—F. Lamson-Scribner, *Chief.*

Office of Experiment Stations—A. C. True, *Director.*

THE AGRICULTURAL EXPERIMENT STATIONS.

Alabama—*Auburn:* College Station; W. L. Broun.† *Uniontown:* Canebrake Station; H. Benton.‡
Arizona—*Tucson:* W. S. Devol.*
Arkansas—*Fayetteville:* R. L. Bennett.*
California—*Berkeley:* E. W. Hilgard.*
Colorado—*Fort Collins:* Alston Ellis.*
Connecticut—*New Haven:* State Station; S. W. Johnson.* *Storrs:* Storrs Station; W. O. Atwater.*
Delaware—*Newark:* A. T. Neale.*
Florida—*Lake City:* O. Clute.*
Georgia—*Experiment:* R. J. Redding.*
Idaho—*Moscow:* C. P. Fox.*
Illinois—*Urbana:* T. J. Burrill.†
Indiana—*Lafayette:* C. S. Plumb.*
Iowa—*Ames:* James Wilson.*
Kansas—*Manhattan:* G. T. Fairchild.§
Kentucky—*Lexington:* M. A. Scovell.*
Louisiana—*Audubon Park, New Orleans:* Sugar Station. *Baton Rouge:* State Station. *Calhoun:* North Louisiana Station. W. C. Stubbs.*
Maine—*Orono:* W. H. Jordan.*
Maryland—*College Park:* R. H. Miller.*
Massachusetts—*Amherst:* H. H. Goodell.*
Michigan—*Agricultural College:* C. D. Smith.*
Minnesota—*St. Anthony Park:* W. M. Liggett.§
Mississippi—*Agricultural College:* S. M. Tracy.*
Missouri—*Columbia:* H. J. Waters.*
Montana—*Bozeman:* S. M. Emery.*
Nebraska—*Lincoln:* G. E. MacLean.*
Nevada—*Reno:* J. E. Stubbs.*
New Hampshire—*Durham:* C. S. Murkland.*
New Jersey—*New Brunswick:* E. B. Voorhees.*
New Mexico—*Mesilla Park:* C. T. Jordan.*
New York—*Geneva:* State Station; L. L. Van Slyke.¶ *Ithaca:* Cornell University Station; I. P. Roberts.*
North Carolina—*Raleigh:* H. B. Battle.*
North Dakota—*Fargo:* J. H. Worst.*
Ohio—*Wooster:* C. E. Thorne.*
Oklahoma—*Stillwater:* G. E. Morrow.*
Oregon—*Corvallis:* J. M. Bloss.*
Pennsylvania—*State College:* H. P. Armsby.*
Rhode Island—*Kingston:* C. O. Flagg.*
South Carolina—*Clemson College:* E. B. Craighead.*
South Dakota—*Brookings:* L. McLouth.*
Tennessee—*Knoxville:* C. F. Vanderford.||
Texas—*College Station:* J. H. Connell.*
Utah—*Logan:* J. H. Paul.*
Vermont—*Burlington:* J. L. Hills.*
Virginia—*Blacksburg:* J. M. McBryde.*
Washington—*Pullman:* E. A. Bryan.*
West Virginia—*Morgantown:* J. A. Myers.*
Wisconsin—*Madison:* W. A. Henry.*
Wyoming—*Laramie:* A. A. Johnson.*

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* Director.
† President of board of direction.
‡ Assistant director in charge.
§ Chairman of council.
|| Secretary.
¶ Acting director.

BULLETIN No. 30

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A. C. TRUE, for the Office of Experiment Stations

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H. H. GOODELL, for the Executive Committee of the Association

1862 1889

WASHINGTON
GOVERNMENT PRINTING OFFICE
1896

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,
Washington, D. C., April 1, 1896.

SIR: I have the honor to transmit herewith for publication Bulletin No. 30 of this Office, containing the proceedings of the Ninth Annual Convention of the Association of American Agricultural Colleges and Experiment Stations, held at Denver, Colo., July 16–18, 1895. The stenographic report of this meeting was made by Mr. J. E. Thomas, of Cheyenne, Wyo.

Respectfully, A. C. TRUE,
Director.

HON. J. STERLING MORTON,
Secretary of Agriculture.

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OFFICERS OF THE ASSOCIATION.

President,

S. W. Johnson, of Connecticut.

Vice-Presidents,

C. Northrop, of Minnesota;
J. H. Connell, of Texas;
S. W. Robinson, of Ohio;
E. A. Bryan, of Washington;
R. H. Jesse, of Missouri.

Secretary and Treasurer.

J. H. Washburn, of Rhode Island.

Bibliographer,

A. C. True, of Washington, D. C.

Executive Committee,

H. H. Goodell, of Massachusetts, *Chair.;*
A. Ellis, of Colorado;
H. C. White, of Georgia;
E. B. Voorhees, of New Jersey;
Ex officio: The President; the Junior Ex President (H. E. Alvord); the Secretary.

Chairmen of Sections.

Agriculture and Chemistry, C. C. Georgeson, of Kansas;
Horticulture and Botany, F. W. Card, of Nebraska.
College Work, A. A. Johnson, of Wyoming;
Entomology, O. Lugger, of Minnesota;
Mechanic Arts, J. W. Lawrence, of Colorado.

Secretaries of Sections.

Agriculture and Chemistry, H. J. Patterson, of Maryland;
Horticulture and Botany, H. L. Bolley, of North Dakota;
College Work, E. Davenport, of Illinois;
Entomology, G. C. Davis, of Michigan;
Mechanic Arts, F. P. Anderson, of Kentucky.

PROCEEDINGS

MORNING SESSION, TUESDAY, JULY 16, 1895.

The convention was called to order at 10.20 a. m. in the "ordinary" of the Brown Palace Hotel by President Henry E. Alvord.

Prayer was offered by President J. E. Stubbs, of the Nevada Agricultural College, and addresses of welcome were delivered by his excellency Governor McIntyre, and his honor Mayor McMurray, of the city of Denver. Response was made by the president of the Association.

The report of the executive committee was submitted by Henry H. Goodell, chairman.

REPORT OF THE EXECUTIVE COMMITTEE.

Immediately after the adjournment of the convention of 1894 this committee met at Washington, D. C., and organized, making choice of Henry H. Goodell as chairman and John H. Washburn as secretary. To the president of the Association, Henry E. Alvord, was assigned the duty of carrying on the negotiations necessary for procuring casts and a marble bust of Senator Morrill, and to a subcommittee, with Henry P. Armsby as its chairman, that of securing the legislation requisite for publishing the results of the Chicago dairy tests. Their reports will appear in this, as part of the whole, submitted by the executive committee.

The different matters referred to this committee have received due consideration, and, in accordance with instructions, it has called the present convention and made the necessary arrangements therefor. It was not found practicable, however, to carry out the wish of the Association to convene at Denver on the week preceding the meeting of the National Educational Association. At the time the vote was taken it was asserted that the date fixed upon by the National Educational Association was the third week of July. That, no doubt, largely influenced the votes of our Association. To have carried out the instructions would have necessitated attendance during the last week in June, and serious interference with the exercises of commencement in many of our colleges. Furthermore, the only concessions in railway rates that could be obtained were available during the meetings of the National Educational Association and the six weeks thereafter. Under these circumstances it was deemed advisable to depart from the instructions given, and place the date of meeting one week after that of the National Educational Association instead of one week previous.

Of the several questions referred to the executive committee one of the most important was that of securing the publication of the results of the Chicago dairy tests. Every effort was made to bring this about, but without effect.

Shortly after its appointment the subcommittee consulted with Assistant Secretary Dabney, Director True, of the Office of Experiment Stations, and Chief Hill, of the Division of Records and Editing. With their advice and assistance a joint resolution was drawn, providing for the publication of the results of the dairy tests in two volumes—one to be in the form known as "census quarto," and to contain the detailed records of the test, while the other was to be in the ordinary octavo form and to contain the summaries and discussions of the results.

This resolution was submitted to Chairman Hatch, of the Agricultural Committee, and was by him introduced into the House of Representatives, where it was referred to the Committee on Agriculture. Mr. Hatch immediately arranged for a hearing on the resolution, at which the subcommittee presented a statement as to the nature of the tests and the value of the results. This statement was very favorably received by the committee, which shortly afterward reported the resolution favorably. As originally drawn, the number of copies to be printed was left blank in the resolution, but these blanks were filled by the Committee on Agriculture so that the resolution as reported by them provided for 5,000 copies of the detailed records and 200,000 copies of the summaries and discussions.

The resolution was next referred, in the ordinary course of procedure, to the Joint Committee on Printing. These preliminary steps having been taken, circular letters were sent to all the institutions represented in this Association, to the leading agricultural papers, and to such individuals as seemed likely to be interested in the matter, setting forth the value of these tests and requesting them to use their influence with their Representatives to secure a favorable report from the Committee on Printing. This committee was slow to act, and after considerable delay it was found that the chairman of the committee was not favorably inclined to the resolution, his opposition being based chiefly upon the cost of the large proposed edition, amounting, according to the estimate of the Public Printer, to nearly $80,000.

Arrangements were at once made by which a conference was had between the chairman of the Printing Committee and the chairman and members of the executive committee of the Association. As a result of this conference the edition to be printed was reduced to 2,000 copies of the detailed records and 20,000 copies of the summaries and discussions, thus reducing the estimated cost to about $20,000. This arrangement was understood to be satisfactory to the chairman of the Committee on Printing, and it was supposed that the resolution would be speedily reported. This, however, was not the case, and in the meantime considerable opposition to the publication of the tests developed, especially upon the part of the Holstein-Friesian Association, which made very strenuous efforts to defeat the resolutions.

After waiting some time for the Committee on Printing to act, another interview was had with its chairman, when it was found, to our great surprise, that he denied having expressed himself as satisfied with the reduction previously made in the edition of the proposed report, and expressed himself as unalterably opposed to the passage of the resolution. It was found impossible to move him from this position, and as a last resort an adverse report from the Committee on Printing was secured for the purpose of bringing matters before the House. During the last five days of the session effort was made by the friends of the resolution, aided by Chairman Hatch, to secure unanimous consent for the suspension of the rules and the consideration of the resolution. The motion, however, though receiving a majority vote, failed to secure unanimous consent, and consequently the resolution failed.

The second matter referred to this committee was the obtaining of a marble bust of Senator Morrill and plaster casts of the same for such colleges as subscribed. In accordance with the action of the last convention, the land-grant colleges were canvassed for subscriptions for the plaster casts of the bust of Senator Morrill, to cost not exceeding $45 each. Twenty-four institutions ordered the same. Four colleges, namely, those of Vermont, Massachusetts, Rhode Island, and Oklahoma, paid in advance, thus enabling the execution of a contract with the sculptor, Mr. Preston Powers, to make the marble bust, to be owned by the Association, and the casts for the colleges. The work has been reported as progressing, and it was hoped that the casts might arrive in New York City and be ready to forward to the subscribing colleges about this time; but no recent advices have come from Florence, where Mr. Powers's studio is located.

Some of the colleges verbally subscribing for casts at the Washington convention have failed to formally ratify such subscription, and this fact, together with other disappointments, have prevented the casts ordered from reaching the number requisite to reduce the cost to $40 each.

Pursuant to the resolutions that "it is the sense of this Association that the executive committee continue its efforts to secure an appropriation for the purpose of furnishing uniforms and such other equipment as may be necessary for the more complete instruction in military science and tactics, and further secure such legislation as shall require one officer of the Army to be detailed to each college receiving the benefits of either of the so-called Morrill Acts," your committee called several times at the War Department, the Inspector-General's Office, and upon various members of the Military Committee. It was the unanimous opinion that it would be unwise at that time to attempt legislation in furtherance of the objects proposed. The attitude of the Department and of the committee was not such as to encourage success. The only point gained was to obtain the insertion of a clause in the army bill, then pending, detailing officers to high schools, that this should not be to the prejudice of those colleges already enjoying details.

In the last report of the executive committee it was stated that the attention of the Secretary of the Interior had been called to the inadequacy of the provisions in the Bureau of Education for maintaining suitable relations with the land-grant colleges, and that he had expressed his intention of taking decided action at an early date, and that it seemed probable that this matter would receive the necessary attention without further effort on the part of this Association. Such, however, was not the case. Through a mistake in transmission, the message of the honorable Secretary was laid before the wrong body, and failed to receive the attention it merited. Considerable time was spent in trying to rectify this error, and when finally the bill introduced reached its proper committee, it was too late to be incorporated in the regular appropriation bill, and it was found necessary to call it up as an amendment in the very last hours of Congress. That it failed of passage was hardly to be wondered at, and the only appropriation made was for a fourth-class clerk in the Bureau of Education to forward the relations between the Bureau and the land-grant colleges. This was so far below the requirements of the proposed office that the executive committee have taken no steps to carry the matter further.

A question engaging the attention of the executive committee and involving correspondence with the Postmaster-General has been the compensation of those officers handling the free mail of the stations. As is well known, a large number of our experiment stations are located in comparatively small country towns, where the extra work imposed upon the postmaster by handling the numerous bulletins sent and received calls for a very considerable addition to the work of the office without any additional compensation. With a view to collecting data sufficient to present to the Postmaster-General, a circular letter was sent to each director asking for information on the following points: Number of bulletins and reports issued; number of pages in each; size of edition and weight of the same. From most of the stations answers were received, and the accompanying table has been compiled from the returns. The year 1893 was selected for the reason that in many States the annual report for 1894 had not yet been published.

Station.	Number of publications.	Number of pages.	Number of pieces handled.	Weight in pounds.
Alabama	11	1, 623, 000	51, 000	5, 930
Arizona	4	134. 000	6, 500	430
Arkansas	7	180, 050	60, 075	....
California	6	3, 222, 000	36, 000	9, 716
Colorado	5	852, 000	29, 000	2, 525
Connecticut (State)	3	2, 455, 000	15, 000	7, 478
Connecticut (Storrs)	3	1, 512, 000	15, 000	2, 455
Delaware	5	668, 000	35, 000	2, 584
Florida	....	....	....	....
Georgia	5	1, 314, 000	46, 000	3, 100
Idaho	6	408. 000	16, 000	1, 300
Illinois	12	2, 967, 720	110, 220	12, 573
Indiana	6	876. 500	41, 500	2, 535
Iowa	4	4, 920, 000	60, 000	12, 857
Kansas	9	1, 290, 000	67, 500	5, 425
Kentucky	5	1, 787, 000	53, 000	6, 164
Louisiana	9	1, 177, 500	38, 000	5, 727
Maine	2	1, 377, 000	8, 500	5, 000
Maryland	7	720, 000	35, 000	2, 939
Massachusetts	24	4, 921, 400	107, 000	17, 009
Michigan	12	6, 284, 000	119, 000	23, 550
Minnesota	8	3, 780, 000	105, 000	12, 639
Mississippi	8	837, 300	39. 300	2, 636
Missouri	3	986, 000	39, 000	2, 032
Montana	7	815, 000	31, 000	1, 755
Nebraska	11	2, 115, 000	86, 000	8, 135
Nevada	5	273, 500	11, 500	1, 653
New Hampshire	7	1, 152, 000	84, 000	4, 170
New Jersey	4	1, 232, 000	41, 000	4, 100
New Mexico	4	248, 500	12, 500	637
New York	13	3, 624, 500	108, 750	12, 535
North Carolina	....	....	....	....
North Dakota	5	678, 000	13, 000	2, 256
Ohio	6	11, 083, 000	260, 000	37, 421
Oklahoma	13	710, 000	37, 600	930
Oregon	....	....	....	....
Pennsylvania	5	2, 844, 000	45, 000	19, 815
Rhode Island	7	1, 958, 000	35, 500	7, 149
South Carolina	5	1, 181, 000	34, 000	5, 080
South Dakota	6	1, 136, 000	51, 000	3, 179
Tennessee	5	610, 000	25, 000	1, 960
Texas	5	585, 000	33, 500	3, 833
Utah	8	2, 026. 300	40, 300	6, 874
Vermont	12	678, 000	22, 000	1, 958
Virginia	13	2, 204, 000	168, 000	5, 857
Washington	....	....	....	....
West Virginia	....	2, 855, 000	....	20, 000
Wisconsin	5	5, 840, 000	55, 000	22, 430
Wyoming	7	1, 048, 000	24, 750	3, 905

It appears from the above figures that in the year 1893 there were issued from 45 stations 317 bulletins and reports, containing 89,191,270 pages. There were handled at the offices from which they were mailed 2,351,995 separate pieces, weighing 322,236 pounds.

Respectfully submitted, for the executive committee.

HENRY H. GOODELL, *Chairman.*

Report accepted.

REPORT OF THE TREASURER OF THE ASSOCIATION.

John H. Washburn, treasurer, in account with the Association of American Agricultural Colleges and Experiment Stations.

Received from M. A. Scovell, treasurer	$82.30
Moneys received for dues in 1893 and 1894	20.00
Received for cast of the bust of J. S. Morrill	45.00
Dues for 1894 and 1895	970.00
Total	1,117.30
Expenditures	551.42
Balance on hand	565.88

ITEMIZED STATEMENT.

Receipts.

1894.			
Nov.	16.	University of Idaho	$10.00
	16.	University of Idaho Experiment Station	10.00
Dec.	31.	Oklahoma Agricultural College, for cast of bust of J. S. Morrill	45.00
1895.			
Mar.	20.	Vermont Agricultural College	10.00
	20.	Maryland Agricultural College	10.00
	20.	Connecticut, Sheffield Scientific School	10.00
	20.	Kentucky Agricultural Experiment Station	10.00
	20.	West Virginia University	10.00
	20.	Massachusetts Agricultural College	10.00
	20.	Hatch Experiment Station, Massachusetts	10.00
	20.	Delaware Agricultural Experiment Station	10.00
	21.	Louisiana State University	10.00
	21.	Alabama College of Agriculture and Mechanic Arts	10.00
	21.	Alabama Agricultural Experiment Station	10.00
	21.	New Hampshire College of Agriculture and Mechanic Arts	10.00
	21.	New Hampshire Agricultural Experiment Station	10.00
	22.	Nebraska Agricultural College	10.00
	22.	Arkansas Agricultural Experiment Station	10.00
	22.	North Carolina Agricultural Experiment Station	10.00
	26.	Cornell University	10.00
	26.	Cornell University Agricultural Experiment Station	10.00
	26.	Louisiana State Experiment Station	10.00
	26.	Virginia, Hampton Normal and Agricultural Institute	10.00
	26.	Virginia Agricultural and Mechanical College	10.00
	26.	Virginia Experiment Station	10.00
	26.	University of Tennessee	10.00
	26.	Kentucky Agricultural and Mechanical College	10.00
	26.	New Jersey, Rutgers Scientific School	10.00
	27.	Georgia Agricultural Experiment Station	10.00
	27.	Connecticut Agricultural Experiment Station	10.00
	27.	Maine Agricultural Experiment Station	10.00
	27.	Maine State College	10.00
	27.	Iowa Agricultural College	10.00
	27.	Pennsylvania State College	10.00
	27.	Nevada Agricultural College	10.00
Apr.	1.	Mississippi Agricultural and Mechanical College	10.00
	1.	Mississippi Agricultural Experiment Station	10.00
	1.	South Carolina, Clemson Agricultural Experiment Station	10.00
	1.	Oklahoma Agricultural and Mechanical College	10.00
	1.	Michigan Agricultural Experiment Station	10.00
	1.	Michigan Agricultural College	10.00
	3.	New Jersey Agricultural Experiment Station	10.00
	4.	Delaware Agricultural College	10.00
	4.	Indiana, Purdue University	10.00
	9.	Maryland Agricultural Experiment Station	10.00
	9.	Connecticut, Storrs Experiment Station	10.00

1895.			
Apr.	9.	West Virginia Agricultural Experiment Station	$10.00
	15.	Rhode Island College of Agriculture and Mechanic Arts	10.00
	15.	Rhode Island Agricultural Experiment Station	10.00
	16.	University of Missouri	10.00
	18.	Iowa Experiment Station	10.00
	18.	North Carolina College of Agriculture and Mechanic Arts	10.00
	18.	Ohio State University	10.00
	18.	Missouri Agricultural Experiment Station	10.00
	18.	Vermont Agricultural Experiment Station	10.00
	18.	New Mexico Agricultural Experiment Station	10.00
	18.	New Mexico College of Agriculture and Mechanic Arts	10.00
	18.	Tennessee Agricultural Experiment Station	10.00
	18.	North Dakota Agricultural College	10.00
	25.	Nebraska Agricultural Experiment Station	10.00
	25.	Indiana Agricultural Experiment Station	10.00
	25.	Oregon Agricultural College	10.00
	29.	Colorado Agricultural Experiment Station	10.00
	29.	Arizona Agricultural Experiment Station	10.00
	29.	Arizona Agricultural College	10.00
	30.	Ohio Agricultural Experiment Station	10.00
	30.	University of California	10.00
May	7.	Utah Agricultural Experiment Station	10.00
	7.	Utah Agricultural College	10.00
	7.	New Jersey Agricultural Experiment Station	10.00
	13.	Minnesota Agricultural College	10.00
	13.	Minnesota Agricultural Experiment Station	10.00
	13.	Wyoming Agricultural College	10.00
	13.	Wyoming Agricultural Experiment Station	10.00
	13.	Colorado Agricultural College	10.00
	13.	South Dakota Agricultural Experiment Station	10.00
	14.	Wisconsin Agricultural Experiment Station	10.00
	14.	Wisconsin Agricultural College	10.00
	27.	Oregon Agricultural Experiment Station	10.00
June	3.	Pennsylvania Agricultural Experiment Station	10.00
	10.	Kansas Agricultural Experiment Station	10.00
	11.	South Carolina, Clemson Agricultural College	10.00
	11.	Oklahoma Agricultural Experiment Station	10.00
	17.	North Dakota Agricultural Experiment Station	10.00
	19.	South Dakota Agricultural College	10.00
	24.	Montana Agricultural Experiment Station	10.00
	24.	Florida Agricultural College	15.00
	24.	Florida Agricultural Experiment Station	15.00
	29.	Illinois Experiment Station	10.00
July	15.	Georgia Agricultural College	10.00
	15.	Kansas Agricultural College	10.00
	15.	Southern University and Agricultural and Mechanical College of Louisiana	10.00
	16.	Illinois State University	10.00
	16.	Washington Agricultural College	10.00
	17.	Montana Agricultural College	10.00
	17.	Texas Agricultural College	10.00
	17.	Texas Experiment Station	10.00
	17.	Arkansas Agricultural College	10.00
		Total receipts	1,025.00

Expenditures.

1894.			
Nov.	16.	Paid Ebbitt House, as per voucher No. 1	$14.05
Dec.	31.	Paid H. E. Alvord, for bust of J. S. Morrill	45.00
	31.	Paid H. E. Alvord, for Association expenses	64.75
1895.			
Jan.	1.	Paid H. H. Goodell, in behalf of Association	7.00
Feb.	12.	Paid Ebbitt House, expenses of executive committee	33.50
Mar.	29.	Paid H. H. Goodell, expenses to Washington	80.50
	29.	Paid H. P. Armsby, expenses to Washington	18.47

1895.			
June	29.	Paid J. H. Washburn, expenses to meeting of executive committee and for postage and printing	$20.11
	29.	Paid M. A. Scovell, expenses for copying dairy test record	79.75
	29.	Paid Carpenter & Morehouse, for printing	20.50
July	15.	Paid M. A. Scovell, expenses to Washington for executive committee	39.45
	15.	Paid A. A. Johnson, for expenses in arranging for meeting at Denver	13.20
	15.	Paid Miss J. Paden, stenographer	3.60
	15.	Paid Denver Hotel Bulletin Company, for printing	12.00
	15.	Paid H. H. Goodell, for sundry expenses paid	36.54
		Total expenditures	551.42

Mr. SCOVELL. I move the usual auditing committee, consisting of three members, be appointed to look over and report upon the annual report of the treasurer.

Carried.

The chair appointed the following committee: Messrs. M. A. Scovell, S. P. McCrea, and A. L. Emigh.

The following resolution was offered for the action of the convention:

Resolved, That no institution shall be entitled to representation or participation in the benefits of the Association unless such institution shall have made the designated contribution for the year previous and that in and for which such question of privilege shall arise, or shall have had said payment remitted by the unanimous vote of the executive committee.

The CHAIRMAN. Only those institutions are entitled to participate, however, in this convention who appear to have contributed to the funds of the Association in accordance with the treasurer's report of last year, which appears in the printed proceedings at pages 19, 20, and 21.

Mr. SCOVELL. I think that one or two stations paid after the report for last year.

The CHAIRMAN. They have been announced by the treasurer and should appear in his report.

The next item of business is to receive the reports from the chairmen of sections. Shall we now proceed with that order? In so doing, I first call upon the chairman of the Section on Agriculture and Chemistry, Mr. Voorhees.

Chairman E. B. Voorhees, of the Section on Agriculture and Chemistry, presented the following report:

REPORT OF THE SECTION ON AGRICULTURE AND CHEMISTRY.

This report of the progress of agricultural and chemical work during the past year must necessarily include much that is not strictly new work. The information arranged and classified here has been gathered both from the reports and bulletins, and directly from the agriculturists and chemists of the various institutions, the latter in response to a circular letter sent out in May last asking for a report of work finished and in progress. The very prompt and generous response to this letter gave abundant and gratifying evidence in respect to the value to scientific agriculture of the work now planned and in progress, the ability and enthusiasm of the scientists engaged, and their interest in the work of this Association.

Of the 54 experiment stations addressed, but 9 failed to report, viz, the State and Sugar Experiment stations of Louisiana, the Cornell Experiment Station of New York, and Hatch Experiment Station of Massachusetts, and those of Missouri, Nevada, Oregon, Delaware, and Kentucky. The failure to make a specific report at this time is undoubtedly due to an oversight, since we are all familiar with the excellent and progressive work of these institutions.

Reports of this sort are mainly valuable in two directions: first, in giving detailed statistics in reference to the number of lines of investigation, the number of workers engaged, and results accomplished; and, second, in showing in addition the bearing of the work of the stations in general, or as a whole, upon the progress of scientific and practical agriculture in the various States.

The detailed statistical work has been well performed by the Office of Experiment Stations, and is a matter of record; I have, therefore, directed my attention more particularly to the general, rather than the statistical features of our progress. It is also plainly evident, because of the intimate relations of chemistry and agriculture, that any attempts to make a distinct separation of the agricultural and chemical work must necessarily result in confusion, hence, in the classification and discussion of the work as outlined in the reports received, the provisions of the Hatch law have been followed to some extent, though not in their regular order.

In the provisions of this law, which come under the purview of this section, the stations are required to conduct original researches or verify experiments on at least eight different lines. The first in order in this discussion is:

I. *The comparative advantages of rotative cropping.*—This work may perhaps be regarded as purely agricultural, since the yield and market value of the crops in a rotation may be readily determined without the assistance of the chemist. In many stations the study of rotation is regarded as incidental to other work, though its importance is emphasized particularly on our stronger lands and in the growth of crops of a high fertility value.

Specific studies are reported as in progress by the Rhode Island, Minnesota, Ohio, Nebraska, Illinois, and Michigan stations. Rhode Island reports six well-planned experiments, the rotation courses ranging from three to six years, with and without the "nitrogen gathering" leguminous crops and adapted to improved methods of cropping. In Nebraska a careful study is being made relative to the place of the sugar beet in the rotation, while in Minnesota the relation of rotation to soil fertility, both as to the form and amount of plant food removed, is the subject of investigation. These investigations may be regarded as new, and it is certain that the data obtained will have a wide application and add much to the somewhat meager fund of exact information on these points. The second division of agricultural work is:

II. *The adaptation of cereals, grasses, and forage plants.*—Studies in these lines occupy the attention of 15 stations, located mainly in the West and South. Those of Arizona, Washington, Idaho, Colorado, Oklahoma, South Dakota, Alabama, and Mississippi are devoting much time to this work. Oklahoma reports that the principal work of the department has been a search for a suitable grass for hay and for pasture, with the result that so far alfalfa comes nearest to filling the demand. Colorado reports flat pea and sachaline total failures, while in Kansas the flat pea gives promise of success. In the Mississippi station special attention has been given to the introduction of new grasses and forage plants, and it has demonstrated that clovers and other legumes can be grown with success, both for forage and for seeds—a very great advantage to the agriculture of the State.

Delaware, Maryland, North Carolina, New Jersey, and Massachusetts are also studying the adaptability and usefulness particularly of new forage plants, and report much of usefulness as a result of their work.

In a sense the results of work of this kind must have a local application, because of variations in conditions. This fact, however, does not detract from its very great practical value, but is rather an argument in favor of more careful work of like character. The benefits conferred upon a State or farming community by the introduction of a new and valuable plant can hardly be overestimated.

III. *The chemical composition of useful plants in their different stages of growth.*—Specific investigations along this line are reported from 10 stations. The Wyoming station is making an extensive study of native forage plants. The Minnesota station reports "a complete chemical study each year of some important farm crop, mainly as to the time of year and stage of development when the food is taken from the soil, the flax plant being the subject of examination in 1895." The composition of the oat plant at different stages of growth to determine its forage value forms an important part of the work of the Michigan and Iowa stations this year, while in Nebraska studies of the chemical changes taking place in the sugar beet during its period of growth is continued. In the other States less elaborate, though important and useful work, is in progress.

IV. *The chemical composition of manures (natural or artificial), with experiments designed to test their comparative effects on crops of different kinds.*—Studies in this line are no longer confined to the older stations of the Eastern and Southern States, but are engaged in to a greater or less extent by nearly all of the States east of the Mississippi River, and to some extent by the stations of the far West and Pacific Slope. Colorado reports experiments with chemical manures in the raw and manufactured state, and also as an interesting fact "that commercial fertilizers are for sale in Colorado markets." The analysis of manures and fertilizers and accompanying experiments is also reported as not an insignificant part of the work of the California station. Among the stations of the East, and South, and Central West, Maine, Connecticut, Rhode Island, Massachusetts, New Jersey, Pennsylvania, Ohio, Maryland, Virginia, West Virginia, North Carolina, Georgia, Alabama, Louisiana, Kentucky, and Indiana report either field or vegetation experiments with fertilizers.

These experiments, while not in any case so elaborate in plan as those in progress abroad, are in a few instances rather extensive, and promise much of value, both in educating the farmer in reference to the character and usefulness of plant food and in adding to the fund of definite knowledge concerning the fertility value and methods of use of the various products.

Ohio reports over 200 tenth-acre plats on the station farm devoted to a series of tests with commercial fertilizers, besides a number on outlying farms for the purpose "of making a complete test of commercial fertilizers on the different soils of the State." The Pennsylvania station reports 144 eighth-acre and 12 twentieth-acre plats devoted to the study of the effects of different forms and kinds of manures and of different methods of application for the different crops, and in addition a series of experiments in cooperation with local organizations to test the effect of different forms and kinds of commercial fertilizers on the yield and quality of tobacco.

Plat experiments, while on the whole forming a very useful line of work in the past, are subject to many inaccuracies, because of uncontrolled conditions. In a number of States, therefore, these experiments are being supplemented and controlled by vegetation or pot experiments. Maine, Massachusetts, Rhode Island, and Connecticut especially report progress in these lines, as well as important additions to their equipment for future work.

V. *The analyses of soils and waters.*—Nine stations, with one exception located west of the Mississippi, report more or less study of soils and waters. The Idaho station has undertaken "a complete soil survey and analysis, as well as a study of the irrigation waters of the State, the investigation to cover a series of years." In North Dakota the analysis of water for sanitary purposes is a prominent feature of the work. In Arizona "a series of water analyses is in progress, with a view to finding the relation of irrigation to alkali under the conditions that obtain in the Territory." The Montana station is studying the effect on plants of waters containing salts derived from the reduction of silver; in South Dakota the waters of shallow artesian wells and of streams flowing over the outcrops of sandstone are being studied. In the Utah and Oklahoma stations the analysis of irrigation waters occupies the attention of the chemists. In California "the alkali problem of the State is in process of investigation, including analysis of soils, waters, and salts;" while in Indiana and Minnesota the humus content of soils is being carefully studied.

VI. *The composition and digestibility of food for domestic animals.*—Digestion experiments are in progress at seven stations. The Storrs station is conducting experiments with sheep, which include a study of the fuel values of the digested nutrients. The Maine station has reported much valuable data secured from digestion experiments with sheep and pigs, and the work is continued, consuming much time of the officers, both in the stables and laboratory. Pennsylvania reports "digestion experiments in progress with milch cows, in connection with which the fuel values of the samples of feed and excreta are to be determined by the bomb calorimeter, besides careful observations concerning the effect of nutritive ratio; also experiments upon cotton-seed meal, covering its digestibility by steers and comparisons of its nutritive effect for dairy cows with that of ordinary feeds."

The Illinois station is studying the digestibility of corn, cowpea, soja bean, silage, and corn fodder by steers. The Massachusetts station is determining the digestibility of various forage plants and concentrated feeds by ruminants, and has tabulated the results of digestion experiments obtained by American stations. In Minnesota the effect of one food upon the digestibility of another is one of the questions involved in an interesting study. In North Carolina much valuable data recently secured will soon be published.

The very considerable amount of excellent work already done, and the promise of that now in progress, because of the high degree of skill, scientific training, and expensiveness of equipment required to successfully carry it out, gives strong proof of the standing and permanency of our institutions.

VII. *The economic questions involved in the production of dairy products.*—The importance of the dairy problem is clearly recognized, and is studied in some of its phases by nearly all of our stations. I shall, therefore, not attempt to do more than to outline briefly the work of those stations in which it assumes a prominent part. Feeding experiments to determine the relative influence of different foods and the preparation of rations upon the yield and quality of the milk are in progress in Illinois, Connecticut (Storrs), Massachusetts, Pennsylvania, New York (Cornell and Geneva), North Carolina, Texas, Iowa, Michigan, and Minnesota. The influence of breed in the economic production of butter fat is a special feature of the work at the Geneva station, from which much valuable data has already been gathered.

Ohio reports the beginning of an experiment with six different breeds, in which it is proposed to study in detail their relative value for the dairy. In Michigan, the effect of the individuality of the animal, of changes of food and of temperature, and of kinds of food and methods of feeding are prominent lines of investigation. In Pennsylvania, in addition to a comparison of the actual feeding value of silage, sugar beets, and mangels, the influence of these classes of foods upon the market and keeping quality of the milk and butter is studied.

The Connecticut station is devoting much time to a study of the economic management of creameries, involving many analyses of milk and cream, and instruction in methods of purchasing the cream. At the Geneva (N. Y.), Minnesota, and Wisconsin stations extensive and most valuable investigations concerning the manufacture of cheese, and the relative value of different milks for the purpose, are in progress.

Studies concerning the health of dairy animals and the purity and healthfulness of dairy products which involve the detection, prevention, or eradication of disease, particularly tuberculosis, and the pasteurization or sterilization of milk and cream also occupy the attention of a number of stations. In North Carolina, Nocards's treatment for abortion has been carefully studied. The Mississippi station reports "the use of the tuberculin test on 62 cows of the station herd with wholly negative results, and that this work is being continued on other herds to ascertain what, if any, foundation exists for the common statement that Southern cows are rarely affected with tuberculosis." The study of this disease is also being continued in Wisconsin, New Hampshire, New Jersey, Pennsylvania, and other States.

VIII. *Other researches bearing directly upon the agricultural industry of the United States.*—Under this heading a very large part of the work of the stations is included, and in order to bring out the essential features we have divided it into five subheadings:

(*A*) *Variety tests and methods of seeding and culture of farm crops.*—Very extensive variety tests are in progress mainly in the corn, cotton, and wheat States, and in those showing a wide variety of soils. Texas leads with tests of 249 varieties of wheat, 49 of field corn, besides tests of a large number of varieties of oats, rye, barley, grasses, clover, and cotton. In Ohio 70 varieties of wheat are being tested at the station farm, and samples of varieties grown there are sent to different sections of the State for a further test of their adaptability to the varying conditions of soil practice.

In Kansas extensive experiments with corn and oats are in progress; in Washington large areas are devoted to testing varieties of wheat, oats, corn, barley, pasture grasses, and forage and hay plants. In Mississippi the station has made an exhaustive study of the several types of American cotton, and their adaptability to the different soil regions; the Georgia station is also engaged in similar work.

The stations of North Dakota, Illinois, Michigan, Minnesota, Iowa, Louisiana, Maryland, and Pennsylvania are also engaged in this work. In most of these stations the study of varieties is also accompanied by careful experiments relative to the time and methods of seeding and cultivation.

(*B*) *Animal nutrition.*—Studies of the nutritive effect of foods and the economical production of beef, pork, and mutton, or energy, as distinct from studies of digestibility and the production of dairy products, are in progress in 10 stations. In North Dakota and Utah careful experiments in feeding horses, both for work and for maintenance, and including several kinds of rough and concentrated foods, occupy a large part of the time of particular officers. In Maine, in connection with the experiments in animal nutrition, "the entire bodies of four steers, fed differently from calfhood, are being analyzed to determine what effect the feeding has had upon the constitution of the body. In Ohio an elaborate feeding test with five breeds of sheep is just begun.

Experiments in pig feeding are in progress in Washington, Wisconsin, and Maryland, and those in the feeding of sheep and lambs at Cornell (N. Y.), Michigan, Wisconsin, and North Carolina stations. In these, too, careful attention is given to crossing of sheep, with a view to developing and improving special characteristics in the production of wool, mutton, and early lambs. Studies in this direction are extremely valuable. Colorado also reports studies in sheep feeding that will cover the whole subject from the range to the market, as well as experiments in the breeding of both sheep and cattle.

(*C*) *The development of natural resources and improvement of industrial interests.*—The stations of Florida and South Carolina are making careful studies of their phosphate deposits. Arizona is studying the fiber plants, and in connection with Texas and New Mexico is continuing experiments to test the growth and value of the cañaigre plant, with a view to its use as a commercial source of tannin. Georgia is studying the starch content of the sweet potato and its suitability as a commercial source of starch. Alabama is conducting investigations relative to the composition and characteristics of sugar cane grown on the elevated lands of the State, besides studying the manufacture and preservation of sirup, with a view to developing the industry, and reports highly satisfactory progress.

The very valuable work of the sugar experiment station of Louisiana, and the extensive studies of the sugar beet in Washington, Nebraska, Utah, Arizona, and other Western States with a view to further development of the beet-sugar industry, are being continued. In New Hampshire, Vermont, and Michigan the maple-sugar industry is materially assisted by the studies of the stations.

(*D*) *Irrigation, drainage, and soil improvement.*—Experiments in irrigation are in progress in a number of the States of the far West, though in many it has passed beyond the experimental stage, while in the East a few stations are planning experiments on this line. The drainage question is not largely studied, though interesting and careful experiments are reported from Illinois, Wisconsin, and other States. Experiments relating to the improvement of soils which are poor both in physical and chemical properties, by means of green manures and chemicals, have been recently begun in many States, notably Maryland, North Carolina, and New Jersey.

(*E*) *Miscellaneous studies and experiments.*—In addition to the specific lines of investigation thus briefly outlined, much work is accomplished in the study of local problems; the preservation and improvement of farm manures, the analysis of fertilizers, fodders, feeds, muck, peat, soils, waters, ores, dairy products, etc., all of which is of very great direct usefulness to the citizens of the various States, and adds materially both to the value and popularity of the stations. In a number of stations research work along many lines and of a highly scientific character is being prosecuted; the study of methods of analysis also occupies the attention of nearly all of the chemists. This is of very great value, and has already resulted in increasing both the accuracy and rapidity of chemical analysis.

During the past year, too, the funds of a number of institutions have been increased, either by generous grants from State treasuries or from the contributions of local organizations, which is gratifying evidence of the appreciation of their work.

In conclusion, it must be remembered that agriculture and chemistry are but two of the many branches of work, and therefore represent only a part of the whole now in progress by the stations.

EDWARD B. VOORHEES, *Chairman.*

The CHAIRMAN. The next in order is the report of the Section on Horticulture and Botany. Mr. Tracy, the chairman, is absent, but I understand that Mr. Lazenby, the secretary of this section, has his report, and it will now be read.

REPORT OF THE SECTION ON HORTICULTURE AND BOTANY.

MR. PRESIDENT AND GENTLEMEN: To itemize the work of the 80 men who are now doing botanical and horticultural work at 50 stations is an impossibility in the twenty minutes assigned for this paper, and therefore the report of progress will be made by subjects rather than by States, hoping that this may give a more comprehensive view of the work in hand.

The work of the true botanist can not be separated from its higher practical development, horticulture, and work in neither line can be made efficient without calling in the entomologist, and also frequently reaching over the undefined boundary between horticulture and agriculture. This is frequently seen in the notes which form the basis of this report, but I quote only from notes sent by those who are officially named as the botanists, mycologists, or horticulturists of the several stations.

Work with fruits is evidently receiving more attention than is any other one subject, as it is mentioned in the reports from every station. The origination of new varieties by crossing and selection is a part of the work of the Indiana, Louisiana, Minnesota, Missouri, Cornell (N. Y.), South Dakota, West Virginia, and Wisconsin stations, while the effects of pollination, both immediate and secondary, are being studied in Florida, Georgia, Maine, Geneva (N. Y.), and Oregon. The spraying of fruit trees has been the subject of special work at the Florida, Louisiana, Mississippi, Cornell (N. Y.), and Texas stations, and is practiced to a greater or less extent at nearly every station. The effects of different fertilizers on the growth of the trees and on the quality of the fruit are being studied in Florida, Mississippi, Texas, and Washington; while the effects of pruning at different seasons is receiving attention in Nebraska, and methods of cultivation are being tested in Maine, Cornell (N. Y.), Oklahoma, South Dakota, and Washington. Missouri and Oklahoma are making large plantings of nut-bearing trees, and Florida has given us the only bulletin on the pineapple.

That the mycologists are cooperating with the horticulturists is shown in the fact that Connecticut, Michigan, Mississippi, both New York stations, Ohio, Tennessee, Virginia, Washington, and Wisconsin each report work on "Diseases of fruits," while Alabama and Connecticut specialize on pear blight, Connecticut and Mississippi on apple scab, and Cornell (N. Y.) and Oregon on "Diseases of stone fruits." Connecticut and both the New York stations are also studying bacterial diseases of plants.

The testing of varieties, both new and old, holds an important place in station work, being mentioned in the report from nearly every station, and as one of the leading lines of work by no less than 16. Many stations report 300 to 500 varieties of fruit in cultivation, while others mention much larger numbers, the New York State station reporting no less than 1,776 varieties. The value of these variety tests has often been questioned, and is a matter which might well be discussed here. One man says, "We are pushing this work at four different stations." Another says, "Our main effort in horticultural work has been given to the testing of varieties of fruits and vegetables." Another says, "Testing varieties is a very minor matter," and still another says, "Incidentally, novelties in fruits and vegetables receive due attention, but 'variety testing' is not made an important feature of our work." I trust that this matter may receive your attention, and that we may have the benefit of your advice.

Work with garden vegetables also claims a large share of attention, as is shown in the fact that 13 stations mention the testing of varieties as being one of the more important lines of work. Seven report work on diseases of vegetables in general, but the greater number confine their work to a few specialties, as at Connecticut, Indiana, Kentucky, New York State, North Dakota, and Wyoming stations, where the work is given to a study of the development and prevention of potato scab, and in Florida and Mississippi, where diseases of the tomato receive special work. The Louisiana, Cornell (N. Y.), and West Virginia stations are doing somewhat extensive work in the forcing of vegetables under glass, and two stations seem to have demonstrated that the electric light may be made an efficient assistant in commercial greenhouse work. Georgia is testing the sweet potato with reference to its value as a basis for the manufacture of starch, and the Louisiana station has introduced a large number of foreign varieties which now promise to be of considerable value.

Not all of the stations confine their work to supplying the wants of the inner man, for Massachusetts and Minnesota are doing good work in the introduction of new varieties of flowering plants, while New Jersey, New York State, and Vermont are doing special work in studying the many diseases which affect both the flower garden and the greenhouse.

Eleven stations report work with diseases affecting wild plants in general, while two have taken a hint from the entomologists and are studying the practicability of using fungi as weed destroyers.

In their studies of plant diseases, and in crossing and hybridizing, many of the station botanists are of great assistance to the agriculturists. Kansas is doing much to prevent the losses caused by the smuts of grains, and Wyoming is also engaged in the same work. North Dakota is making a study of some of the physiological problems which confront the wheat grower, while Kentucky, Louisiana, and Wisconsin are doing a similar work for tobacco growers. Alabama, Florida, and Mississippi are naturally working with cottons, examining the types of native varieties and introducing foreign sorts, from which they now have some thousands of hybrids in cultivation. Diseases of cotton claim attention in Alabama and Mississippi.

Ten station botanists report special work with grasses and forage plants. Several of these are saving seeds from selected plants in an endeavor to establish improved races, and the experience so far gained seems to indicate that this may be a fruitful field for work. Georgia, Louisiana, and Oklahoma are all engaged in working out the difficult problem of the botanical and cultural varieties of the cowpea, a study which will require some years of careful investigation for its completion.

Several of the Western States, including Arizona, Minnesota, Oklahoma, Utah, and Washington, are studying forestry problems, and are testing both varieties and methods.

Local conditions often call for special crops, and we find Louisiana making extensive cultures of fiber plants, and Nebraska of honey plants, while the North Carolina station, located near the greatest herb market in the country, is giving special attention to the methods of cultivation for medicinal plants.

The farmers and gardeners are not the only ones who have to contend with weeds, for we find no less than 9 stations reporting a study of their distribution and the simplest means for eradicating them as being important lines of work. Several bulletins on the subject have given excellent means for the recognition of dangerous new arrivals, but we are sorry to say that as yet we have no bulletin which enables us wholly to dispense with the old-style hoe.

In seed testing, North Carolina is perhaps doing more than any other station in testing the purity and vitality of commercial seeds, and Michigan is doing a great amount of work on the longevity of weed seeds when exposed under different conditions. Indiana, Louisiana, and Maine are studying the effects of climate on the amount, vitality, and successive generations of seeds, and when their work is completed it is hoped that we may know something definite as to the real importance of the common practice of changing the location of the seed supply as compared with careful and continued selection of seeds grown continuously in a single locality. In the same connection may be mentioned the work of Nebraska in studying the effects of local factors, wind-breaks, soil moisture, etc. Indiana is studying plant nutrition and the physiology of plant growth, and pot work with fertilizers is being done at the Connecticut, Georgia, both New York, and Washington stations.

Although the dairymen long ago came to the chemist for help, it is only quite recently that they have learned that they must come to the botanists to secure desirable flavors for their products, and the "Bacteriology of the dairy" now holds a prominent place in the work of the North Dakota and the Wisconsin stations.

Five stations are largely engaged in the introduction of foreign plants, both for their possible value for cultivation here and for use in crossing and hybridizing with our present varieties for the establishment of new sorts. Many of these introductions promise to be of great value, though in most cases years must elapse before we shall know their true standing. Arizona evidently favors the protection of home industries, and not content with showing us the value of dock as a field crop is now engaged largely in the cultivation of cacti.

The horticulturists and the entomologists are naturally working together in devising means for the control of insect pests in nearly every station, and in Michigan they are making a study of the fungoid diseases of insects, while in Washington the value of bees in the orchard is receiving special attention.

There is scarcely a station which is not doing more or less original work in the use of fungicides and insecticides, and every effort is being made to find combinations of the two which will obviate the necessity for the double sprayings which have been necessary heretofore. Several such combinations are in rather common use, which, with the greatly improved nozzles and spray pumps now in the market, have greatly decreased the labor of spraying. This cooperative work of the botanists, horticulturists, and entomologists has been of inestimable value to the fruit and vegetable grower in giving him practical immunity for his crops with a minimum amount of labor.

The Louisiana and West Virginia stations are making their work felt through their respective States by the propagation and free distribution of plants and seeds of such new varieties of plants as have been found desirable, and that line of work seems to be accomplishing good by making the stations better known and more popular.

The stations in Alabama, Colorado, Louisiana, Mississippi, Nevada, and Wyoming are pushing botanical surveys in their respective States, in part for the botanical interest of the work and in part for the great value of the information which a record of plant growth and distribution will give concerning the soils in different sections. With this work of course comes the accumulation of an herbarium, which is essential for the recognition of the hosts of plant fragments which are sent to every station botanist for identification. New Mexico is carrying this survey one step further than is usually done, and is studying the effects of elevation with a view to the establishment of "plant zones," of which several are plainly recognizable in that region of snow-capped mountains and arid plains.

Irrigation, both surface and subearth, is yearly claiming more attention, and, somewhat strangely, we find that fully as much work is being expended in that direction in the East as in the West, which may be partially from the fact that it is a new line of inquiry in the Eastern States. This matter received considerable attention at our last meeting, and a number of station workers have come to this meeting principally to learn more of a subject which promises to become of great importance to the market gardeners of the East.

This brief outline would be very incomplete were no mention made of the extensive and valuable work which is being done for both botany and horticulture by the Department at Washington. In the purely botanical work the botanical survey of the whole country is being vigorously pushed; special assistants are being employed in the investigation of commercial seed supplies, in germination tests, in the investigation of pharmacological and poisonous plants, and in several other lines. The newly established division of agrostology is not only working for the agriculturist in testing the hay and pasture values of different plants, but is preparing a handbook of grasses, which has been so greatly needed by every botanical worker. The mycologist has always been the pioneer in the work of spraying and in the preparation of fungicides, and his assistants are now engaged in studies of several obscure bacterial diseases, diseases of citrus fruits and other subtropical plants, diseases of grapes, diseases of cereals, and several other important subjects.

The work of a station can be of but little value if results are not published and distributed to the public, and that this is realized by our workers is shown in the 117 bulletins on botanical and horticultural subjects which have been issued during the year, and this in addition to perhaps a still greater number of pages in the various annual reports. These bulletins have been, almost without exception, carefully digested papers, containing definite original information which has been gained by the several workers, and which is of value to the working farmers as well as to the fruit growers and gardeners. No one who has watched the station bulletins since 1888 can have failed to note the great change and improvement in their character as long-continued and intricate lines of investigation have been completed, and their appreciation by the public is shown in the greatly increased personal correspondence which is mentioned in nearly every report. In several States, and notably in New York, special State appropriations have been made for the purpose of increasing the scope of the horticultural work of the respective stations, and we all know that such appropriations are not made until they are called for by a strong public sentiment.

All experiment work is cumulative in its value and its effects. The botanists and horticulturists have already secured practical results of great interest in nearly every line of investigation which they have undertaken, and there is every reason to believe that each succeeding year will show results of still higher merit.

Respectfully submitted.

S. M. TRACY, *Chairman.*

Mr. C. P. Gillette, chairman of the Section on Entomology, presented the report of that section, as follows:

REPORT OF THE SECTION ON ENTOMOLOGY.

Previous to the passage of the Morrill bill for the establishment of agricultural colleges in the various States, the number of economic entomologists in this country could be counted on the fingers of one hand. In fact, if we mention the names of Harris, Fitch, and Walsh, the number is practically told. When the Hatch Act passed in 1888 the number of living men who had gained some prominence as economic entomologists would hardly treble the above list.

With the introduction of a larger number of cultivated plants, the increased area of cultivated lands, the destruction of native food plants, the introduction of foreign insect foes, and the necessity of more intensive agricultural methods, came the imperative need of a better knowledge of our insect pests and the methods of subduing them. In response to these demands there has been a constantly increasing number of workers devoting their attention to the subject of economic entomology in its various phases, and each year there is being accumulated a large amount of information of permanent value upon the habits, life histories, and methods of combating our insect enemies, mostly stored away in the bulletins of experiment stations and the publications of the Division of Entomology. Each year our methods of investigation have improved, insectaries are built, and new remedies or methods of applying them are discovered, and yet there is large room for improvement.

When the first organization list of the various agricultural colleges and experiment stations was published in 1889 there were 20 stations having officers whose duty it was to devote some time to entomological work. Since then the number has increased so that now we have 42 station entomologists and only 12 stations not so provided. In these 42 stations and colleges there are 57 entomological workers, 15 of whom are assistants, and there is a gain of 4 entomologists this year over last year. This number seems too large, and so it should, for there are but 7 of these workers who represent whole numbers, and 4 of them are assistants. The fraction of their labors that these men devote to entomology is in many cases very small, varying, according to their own estimates, from one twenty-fifth to nine-tenths. The entomological time of all of these fractions added together amounts to 17. If to this number we add 7, which represents the number who are devoting their entire time to entomological work, we find that we have an equivalent of 24 whole men doing entomological work, but this work is distributed in 42 localities among 57 laborers.

There are 9 station entomologists who have no college work to do, but there are only 2 entomologists of agricultural colleges not connected with station work. The amount of ground that some of these men have to spread themselves over is appalling, and readily explains why more original work is not being done. Let me cite a few examples of what they have to do. One has entomology, botany, horticulture, landscape gardening, and forestry; another, botany, horticulture, entomology, and general zoology; another, arithmetic, word analysis, physiology, zoology, histology, and entomology; one is director of the station, and is horticulturist, entomologist, and mycologist at the same time. And so it goes through nearly the entire list, and usually with both station and college work to do. No wonder that the prevailing cry among these men is for more time to devote to entomological work. One, in answering my question as to what was the greatest need of his department, answered, "Ability to do three days' work in one." In two other cases the answer was, "An entomologist." These latter, having so little time to devote to entomology, felt that they ought not to be called entomologists. Better libraries for reference, better collections of determined insects, and means of transportation seem to be among the most pressing needs of the station workers.

But with all the drawbacks that station entomologists have to contend with, there have been published the past year 29 bulletins that were wholly or in part entomological, and which contained 1,336 pages of printed matter. If to this we add the 790 pages published by the Division of Entomology, we shall have enough to make over 5 octavo volumes of 400 pages each.

Seventeen of our college and station entomologists find time to carry on purely technical work, some of them working in two or three different orders. The Hemiptera and Hymenoptera seem to be the favorite orders for special study. From the reports sent in to me the workers are distributed as follows: Workers in Hemiptera, 6; Hymenoptera, 4; Neuroptera, Orthoptera, and Lepidoptera, 2 each; Thysanura, Odonata, Siphonaptera, Mallophaga, Diptera, Coleoptera, and Acarina, 1 each.

A number of the institutions have excellent collections, but it is to be regretted that so many—and some of them in the older and wealthier States—have no determined collection worth mentioning. The following will indicate where some of the best collections in the different orders may be found. The numbers given are the approximate numbers of determined species in each case.

In Hymenoptera: Michigan, 1,500; Cornell (N. Y.), 667; Kansas and Colorado, 500 each; West Virginia, 470.

In Coleoptera: Michigan, 7,500; Cornell (N. Y.) and Kansas, each 3,000; New Jersey, 2,500; Iowa, Nebraska, and Colorado, each 2,000.

In Diptera: Cornell (N. Y.), 580; Nebraska, 250; Iowa and Kansas, each 200.

In Lepidoptera: Michigan and New Jersey, each 3,000; Cornell (N. Y.), 1,626; Colorado, 1,000.

In Hemiptera: Iowa, 1,000; Colorado, 650; Cornell (N. Y.), 518; Michigan, 500.

In Neuroptera: Cornell (N. Y.), 200; South Dakota, 100; others small.

In Odonata: Nebraska, 50; South Dakota, 20.

In Thysanura: Cornell (N. Y.), 100.

In Arachnida: Cornell (N. Y.), 338.

These numbers do not include the private collections of specialists, which in some cases exceed the collection of the institution where they are situated.

It should be said that the University of Illinois and the Massachusetts Agricultural College were not heard from in regard to their collections, which we know are large.

In response to my question asking the names of 10 insects causing heaviest losses in the different States, over 90 species have been named, aside from such terms as "cutworms," "wireworms," "plant lice," etc. I give below, as a matter of record, 20 of these, with the number of times each was reported:

Carpocapsa pomonella, 22; Cutworms, 19; *Heliothis armigera*, 12; *Doryphora 10-lineata*, 9; *Aspidiotus perniciosus*, 8; *Pieris rapæ*, 8; *Conotrachelus nenuphar*, 7; *Chrysobothris femorata*, 7; *Schizoneura lanigera*, 7; *Blissus leucopterus*, 7; *Diabrotica 12-punctata*, 7; White grubs, 7; Plant lice, 6; Wireworms, 6; *Cecidomyia destructor*, 5; *Macrodactylus subspinosus*, 5; *Hæmatobia serrata*, 5; Grasshoppers, 5; *Diabrotica vittata*, 4; *Saperda candida*, 4.

The number of students that received instruction in entomology in the agricultural colleges of the country the past year is about 775, and the number that have taken advanced work is about 75. Professor Popenoe, of Kansas, can boast of the largest class, consisting of 120 students, and Professor Osborn, of Iowa, comes next with a class of 81. Professor Popenoe also had the largest number of special students, 10, while Dr. Fernald, of Massachusetts, had 7, the second largest number.

The New York State Station has published the largest number of entomological bulletins the past year, which is 6. The stations publishing the largest number of pages of entomological matter are: New Jersey, 255; Colorado, 137; Geneva (N. Y.), 118.

It is difficult to say what the most important advances in the economic entomology of the country for the past year have been. Probably none are really more important than the extensive experiments carried on by Dr. Forbes to determine the practicability of using chinch-bug diseases for the extermination of the bugs by artificial means. The invention by Professor Weed, of the Mississippi Experiment Station, by which kerosene can be applied with water directly, without first making an emulsion, is worthy of special mention; and the use of arsenate of lead by T. C. Moulton, in cases where the other arsenites are liable to do injury to foliage, is a matter which promises to be of no small importance.

C. P. GILLETTE, *Chairman.*

Mr. F. P. Anderson, of Kentucky, secretary of the Section on Mechanic Arts, presented the report of that section, as follows:

REPORT OF THE SECTION ON MECHANIC ARTS.

During the past year an effort has been made to develop, practically, but one side of the Section on Mechanic Arts, viz, the correlation of mechanic arts and agriculture.

The Society for the Promotion of Engineering Education covers the broader field of engineering, and we believe that our range of work in this Association should be a limited one.

By well-directed efforts the Section on Mechanic Arts can be made a valuable adjunct to the agricultural side of this Association by bringing more intimately in contact the agricultural and mechanical work in the colleges.

We believe that some steps should be taken to send at least one delegate from the colleges of the Association to represent the mechanical side of our institutions, but if such a move is to be made the agriculturists must take the initiative.

Most of our men interested in mechanic arts are indifferent toward doing work for the Association, claiming that the Association is essentially agricultural and it is the intention of the agriculturists to keep it within such limits.

Mr. BURRILL. I rise to make an announcement and to offer a motion, which, perhaps, in character is not usual in our Association, but which I am sure I will be excused for presenting here. Some forty years ago Dr. Norton S. Townsend, of Ohio, commenced giving instruction in agricultural topics in the school which he established, and he has continued it from that time in one capacity or another until a very recent date. He was connected from the beginning with the State University of Ohio in the same capacity, that of agricultural instructor in that institution, and, although 80 years of age, was still enjoying very fair health and possessing a goodly degree of activity. Quite suddenly he was taken sick, and died since most of us left our homes last Saturday evening. He is to be buried to-day. I move you, sir, that a committee composed of three of those best known and most intimate with Dr. Townsend be appointed to present fitting resolutions in this case.

Mr. COOKE. I second the motion.

The motion was adopted, and the chairman appointed as a committee Messrs. T. J. Burrill, W. W. Cooke, and L. B. Wing.

The CHAIRMAN. The chairman of the executive committee wishes to make an inquiry or announcement.

Mr. GOODELL. There have been received two or three invitations from different bodies here in Denver extending various courtesies to the delegates of this convention, and of these the one seeming most practicable to the executive committee is that tendered by the Chamber of Commerce to take a car ride through the city on Thursday afternoon at 4 o'clock. The executive committee, out of the different invitations that have been extended, recommend this and offer it for your adoption. In case it is accepted, the cars will be in front of the Brown Palace Hotel at 4 o'clock, returning in two and one-half hours, so as to enable us to be present at the business meeting in the evening.

Mr. ELLIS. I move that the very courteous invitation of the Denver Chamber of Commerce be accepted.

Mr. McCREA. I second the motion.

Motion adopted, and the chairman of the executive committee requested to communicate the fact to the secretary of the Chamber of Commerce.

On motion of Mr. Myers, the session adjourned at 12.20 p. m.

EVENING SESSION, TUESDAY, JULY 16, 1895.

The general session convened in the Denver Chamber of Commerce at 8 p. m., Vice-President A. A. Johnson presiding.

Mr. GOODELL. To the executive committee there has come a petition, signed by eleven delegates, asking that a section on irrigation may be organized as one of the sections of the Association. The executive committee understands that this means a permanent organization. Under the rules of the Association that will require due notice to the Association, and come up at the next annual meeting. The executive committee makes no recommendation, as it is to come up in due course before the next convention.

The PRESIDING OFFICER. The provisional section, however, if it should be requested, could be formed for this present meeting.

Mr. REDDING. I desire to refer to the report of the executive committee. A portion of that report had reference to an effort being made on the part of that committee toward procuring extra compensation for those fourth-class postmasters at experiment stations who handle large amounts of the franked matter of those stations. I move to refer that portion of the report to a committee of three to be appointed by the Chair.

Carried.

The PRESIDING OFFICER. I will announce the names of the members of this committee a little later during the session.

According to the programme the hour has arrived for the annual address of the president of the Association. I need not take any time to introduce to you the president of this Association, so long and favorably known, but I do desire to say, for the benefit of the younger members, and citizens of Denver who may be present, that the president is the father of this Association; and it is with great pleasure that I now introduce Prof. Henry E. Alvord, president of the Association.

ANNUAL ADDRESS BY THE PRESIDENT.

In approaching the duties of this occasion, it has been noted that the Association meets for the first time in the western half of our country, among people to whom the organization must be comparatively unknown, and that delegates are here present from institutions never before represented at the annual gathering, although this is the ninth convention. Under these circumstances, it seems appropriate to consider the origin of this Association, review its work to the present time, and make some suggestions as to its future policy.

For nearly twenty-five years after the land-grant act of 1862, there seemed to be no special bond of union between the institutions established or enlarged upon the Morrill foundation. While nearly all were popularly known in the early years, and are still, as "agricultural colleges," they were, in accordance with the terms and very intention of the law, so diverse in organization, management, and general character, as to possess few common features. They could hardly be recognized as belonging to a special class, or forming an educational group by themselves, aside from the single fact of all receiving benefits in greater or less degree from Federal land grants. Some gave no technical instruction in agriculture, others none in mechanic arts, and even the one specific requirement to include military tactics was entirely ignored by some and by others accorded a perfunctory and very reluctant recognition. On three occasions, several years apart, there were fairly representative gatherings of officers of these institutions, and a few days were passed each time in pleasant and profitable intercourse and discussion, but without lasting results. Even the repeated efforts of Senator Morrill to secure further endowment for these institutions failed to arouse any lively interest or develop cooperation on their part in any systematic or cohesive form.

On the 8th and 9th days of July, 1885, another meeting of land-grant college officials was held at the United States Department of Agriculture, upon invitation from the Commissioner. This was a well-attended and earnest gathering. It was conducted in much the same way as the conventions of this Association,[1] and may be regarded as the forerunner of this organization. The first business presented, and that which occupied the most time, was "the Cullen bill" (H. R. No. 7498, Forty-eighth Congress), for the establishment of agricultural experiment stations, and for which the Hatch bill was substituted in the next Congress. This bill had been already explained to Congressional committees by some of the early and enthusiastic station workers of the country who volunteered for this service,[2] and the convention of 1885 appointed three representative college presidents[3] as a committee on legislation, to advance the interests of the agricultural colleges in this connection. These gentlemen, with others whom they invited to cooperate, assisted in preparing the Hatch bill and making its purposes known to Congressmen. They labored continuously and effectively, defraying their own expenses, until the passage of the act.

The advantages of conference and cooperation became so apparent at the convention of 1885 that a permanent organization representing the land-grant colleges was proposed, and an executive committee[4] was appointed, with authority to call the next convention, an advisory committee being added, of one from each State and Territory. But these committees never acted, and no later convention was called by them.

The Hatch Act became a law in March, 1887, and was expected to go into effect at once. But it was soon discovered that no appropriation had been provided to make it operative, and it was thought that all action under it must be postponed for a year or more. This was a great disappointment and was then regarded as quite a calamity; but we can now see that the delay was a fortunate one, giving time needed for organization, maturing plans, and starting in the right way. During the summer of 1887, the officers of the institutions to become beneficiaries under the Hatch Act, and upon whom devolved the duty of its execution, realized the necessity for conference and an agreement upon some basis for uniformity of action, within reasonable limits. This led to calling the convention at which this Association had its birth.

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[1] Committee on order of business and resolutions: Messrs. Alvord, Lee, Knapp, Fernald, Atherton, Willits, and Dabney.

[2] Presidents Atherton, Willits, and Lee.

[3] Messrs. George H. Cook, Brewer, and Atherton.

[4] Messrs. Atherton (chairman), Cook, Knapp, Peabody, Curtis, and Newman.

On the 18th of October, 1887, representatives from land-grant institutions in most of the States and Territories, met at the Department of Agriculture, Washington, and for three days earnestly discussed the Hatch Act and the duties and responsibilities which it involved. Cooperation and some organic union was recognized as important, and hence a permanent organization was effected and the Association came into existence, which has since held an annual convention and is here assembled.

Serious misapprehension has existed in some quarters as to the real objects and actual work of this Association, and selfish and mischievous motives have been assigned to it. As a result, a few of the institutions eligible to membership, and which should actively participate, have held aloof.

Especial attention is therefore now invited to the record. It is practically all in print. There has been nothing to conceal, or of which anyone should be ashamed. It may be broadly and positively asserted that from the first a most creditable spirit has animated all its proceedings. In both college and station matters an earnest purpose has been evinced to faithfully and efficiently execute the great trust reposed in the institutions concerned by the Congress of the United States, to use the instrumentality and influence of this Association in the interest of true economy in the large annual expenditures made, to raise the standard of the work and extend the field in which it is applied.

This is not an association of individuals, but of institutions, created and endowed by national, State, and Territorial laws, and united for the purpose of mutual aid and the promotion of common interests, which are public interests. The institutions are represented by delegates, including trustees or members of the governing boards, college presidents and professors, and station directors and staff officers. The Association has two ways of accomplishing its work. First, by delegates assembled in annual convention, and, second, by committees chosen from these delegates to represent the Association and its interests between succeeding conventions. The proceedings of the eight conventions heretofore held have been published by an Executive Department of the Federal Government from notes taken by official reporters and edited by a departmental officer acting jointly with a representative of the Association. Although the published record of the first meeting is incomplete, these pamphlets may surely be regarded as constituting an authentic record, and, indeed, an official one. At every convention since the first, the executive committee has reported all action taken in the name of the Association since its last gathering. These reports are incorporated in the proceedings, and I claim to be a competent witness to their completeness and accuracy. The receipts and expenditures of the Association, and the nature of the latter, are also included in these printed records. The whole history is therefore open to inspection. It comprises about 1,000 octavo pages, and can not, of course, be reviewed in detail at this time. But it may be well to briefly present some of its prominent features.

First, let it be noted that this Association did not come into existence until some months after the Hatch Act had become law by a very large majority of the votes in both branches of Congress and been approved by a President, who stated to the Association representatives last November that he had become fully convinced of the wisdom of that approval seven years before. President Cleveland added that of all the annual appropriations of money from the Federal Treasury which had come under his observation, none seemed capable of more useful results, provided the application was honestly and judiciously made in the several States and Territories.

If a few gentlemen who have since been more or less identified with this Association saw fit to voluntarily contribute their time to promote that wise legislation in an entirely legitimate and proper way, they simply exercised the right of every American citizen, and should be credited with having performed an eminent and lasting public service.

The first meeting of the Association was occupied mainly in considering how the Hatch Act could be best executed, and after mature consideration, a declaration was adopted as to the organization of experiment stations and maintaining the integrity of station funds. This declaration will be later recalled. A special committee was appointed, composed of three of the most experienced directors of State experiment stations,[1] and the Department published and distributed the report of this Committee on Station Work, which was replete with suggestions and advice to the stations just organizing, as to material equipment, lines and methods of work, and means for disseminating information. The important assistance of a good library of reference as recognized, and a list of books desirable as a basis for such a library was kindly prepared by Professor Johnson, at the request of the Association, printed and furnished to all interested.

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[1] Messrs. Atwater, Johnson, and Cook.

The Hatch Act had been approved during the closing days of the Forty-ninth Congress, but no money appropriated to carry it into effect. It was admitted by all that such an appropriation would be made at the first session of the Fiftieth Congress, but under the usual course of procedure this would not occur until June or July—too late to be available for station work during the agricultural year of 1888. Accordingly, when Congress met in December, 1887, the executive committee, acting in behalf of the Association, made a full presentation of the subject to the proper committees, and this resulted in a special act of appropriation, approved February 1, 1888—in ample time for every organized station to use the whole of the growing season of that year and derive full benefit from the first station annuity of $15,000 for the fiscal year ending June 30, 1888.

It became necessary to arrange, also, before the Association met again, for the appropriation for the fiscal year of 1888–89, and to get this annual station supply placed, as a precedent, in charge of the most suitable and best informed Congressional committee. In accordance with the expressed wish of the first convention, provision was secured in the second appropriation bill (approved July 18, 1888) for establishing the Office of Experiment Stations in the United States Department of Agriculture.

During the year 1888 various questions of considerable consequence arose as to the interpretation of the Hatch Act by Government officials, and attention was given, on behalf of the Association, to obtaining satisfactory decisions by the Treasury Department and Post-Office Department. All these matters were promptly communicated by Association circulars to the officers of all institutions concerned, and the subjects were fully explained in the report of the executive committee to the second convention.

This second convention was held at the University of Tennessee, in Knoxville, the first days of January, 1889. It had been agreed in advance that the sessions should be mainly given to experiment-station questions, and a recital of the topics discussed will show how the convention occupied its time, viz:

"The Relation of Colleges and Stations."

"How can Stations reach and interest farmers?"

"How can the Department of Agriculture assist the Stations?"

"How can Stations cooperate?"

"The substance and form of the Annual Station Report."

"The practical work of Colleges and Stations."

A very important action by the Knoxville convention, was one which led to a long and satisfactory conference in February, 1889, between the President-elect of the United States and representatives of the Association, and in the month following between the latter and the newly installed Secretary of Agriculture. Four years later this action was repeated. It is undoubtedly due to the existence of this Association and its active influence that the scientific divisions of the Department of Agriculture hold their present satisfactory status and that Assistant Secretaries of that Department have been selected so fully in harmony with the Association itself and with the work of investigation and instruction which it represents.

The third convention was held in Washington in November, 1889. Among the general questions discussed were the following:

"The annual report of institutions organized under the act of July 2, 1862."

"The primary obligations of Colleges and Stations under the Hatch Act."

"The relations between colleges and experiment stations and the agricultural exhibitions, institutes, and other public meetings in their respective States."

"Uniformity in the methods and records of chemical laboratories."

This convention differed mainly from those preceding in giving less time to general questions and more to special subjects, considered in conferences of the specialists interested. The constitution of the Association was amended to provide for both permanent and temporary sections, to be assigned an appropriate part of the time at every annual gathering for the consideration of topics not requiring the attention of delegates in general. But in order that all might know from time to time what matters the sections deemed important, provision was made for the several sections to periodically present in the general sessions of the convention a portion of the subjects coming before them. Experience demonstrated that too many permanent sections caused confusion and waste. Hence amendments which brought the constitution to its present form, which has proved so satisfactory that further change should be avoided as long as possible. Delegates who find that their particular wants are not provided by the regular sections have a constitutional remedy, as they can secure through the executive committee the organization of a temporary section at any convention.

In connection with its later years, it should be noted that without radical changes our organization has made a natural and healthy growth, adapting itself, its rules, and methods to its developing needs so as to economize the time of delegates, and make its deliberations and action useful and effective in advancing the great interests which it represents.

The year of 1890 was one of unusual activity on the part of this Association, its agents, and representatives. The organization aided in accomplishing four things worthy of special mention, two for the stations particularly and two for the colleges:

(1) The original "Cullen bill" provided that the payments of appropriations to stations should be made quarterly in advance. This feature was accidentally omitted from the Hatch Act, and stations were greatly hampered in their work for two or three years by the necessity for long credits or of paying interest on loans. Through proper representations made to the Agricultural Committee of the House of Representatives, the wording of the annual appropriation under the Hatch Act was changed in 1890 so as to secure quarterly payments in advance, and this desirable and truly economic change has become a permanent feature of the annual act.

(2) Negotiations at the Post-Office Department secured an entire revision of the regulations for free mailing of station reports and bulletins. The existing regulations are liberal and convenient, but although accessible in print, they do not seem to be fully understood. Station publications may be sent singly or in parcels, the latter to be opened and distributed by postmasters. Envelopes may be sealed or unsealed. Publications mailable free by the United States Department of Agriculture or by any station may be so mailed by any other station. If station reports "be printed by State authority, and consist in part of matter relating to the land-grant colleges to which such station is attached, then said report may be mailed free entire." But the whole must, in the judgment of the director, consist of useful information of an agricultural character. With this very general limitation large discretion is vested in the station officer to whom the free-mailing privilege is accorded, and whose signature, or facsimile thereof, is responsible for what it covers and must be so used as to guard against abuses.

(3) A special committee, after prolonged conferences at Washington, concluded very satisfactory arrangements with the War Department as to its relations with the colleges having army officers detailed as instructors. General orders were promulgated accordingly, and these have not since been materially changed.

(4) The Association contributed materially to the early enactment of the law for "the more complete endowment and support" of land-grant colleges. Senator Morrill expressed by letter his appreciation of the valuable service rendered in promoting the passage of the act of Congress approved August 30, 1890.

These matters were fully reported by the executive committee to the fourth annual convention held at the University of Illinois, Champaign, in November, 1890, and, with the discussions thereon, appear in the record of that gathering.

Criticism has been made at times upon the part taken by this Association in the promotion of legislation affecting the interests it represents. Some institutions have even declined to participate in the annual gatherings and contribute to the necessary support of the organization upon this ground. Great misapprehension as to the actual facts can alone account for such opinions and action. The record should be made so clear that mistakes of this character can not occur again.

The fact that the Association did not come into existence until some months after the passage of the Hatch Act has been already noted. The action of the Association in helping to secure rational interpretation of that law and its early and efficient administration, has been also explained and shown to have had as its commendable object the honest, economical, and effective application of the public funds. In the same line may be mentioned the later and repeated efforts of the Association, finally successful, in having ample authority given to the Secretary of Agriculture to regulate the accounts, inspect the work, and supervise the expenditure of the money annually granted to the stations. The only just criticism of this organization as related to experiment-station legislation and administration, is that it has been an earnest and active agent for improving this branch of the public service.

As to college legislation, the second Morrill Act is the only matter with which the Association has had any connection, excepting minor points relating to military departments in the several institutions. This new legislation was neither asked nor suggested by this Association and but few of its representatives, if any, knew that the author proposed to introduce the measure in the Fifty-first Congress. It is a matter of public record that but a few years elapsed after the passage of the original college land-grant act (1862) before Senator Morrill realized the necessity of strengthening the work founded thereon by further endowment. At sundry times during twenty years preceding 1890, bills having this object were introduced by Mr. Morrill and in several instances passed one or the other branch of Congress, or both, without any particular agitation or extraneous effort. In the spring of 1890 Senator Morrill believed the time had come for another trial and introduced his bill in April. The new Morrill bill had such inherent merits and the subject was so familiar to Congressmen and so favorably regarded by them, that it would doubtless have become a law, in some form, in the course of time, if left to pursue the usual routine of unaided legislation. But after the measure came before the Senate this Association was invited by its author to assist in its passage, by explaining the needs of the institutions to be "further endowed" and the benefits to be derived from the act proposed. Just this was what the several representatives of this organization did, who were in Washington at frequent intervals during the four months between the introduction of the bill and its passage and approval. The influence of the Association was exerted in an entirely unobjectionable manner to put the bill into practical and useful form and then to secure action upon it. An overwhelming majority in favor of the measure was apparent in each branch of Congress, but, in the pressure of various matters for priority on the Calendar, a friendly and active interest was necessary and proper to obtain consideration, and a record of the votes waiting to be cast for it. (The bill passed the Senate on June 25, and the House on August 19.)

The action of this Association, connected with the new Morrill Act, and of all who represented it in this matter, was open and honorable in all respects, and rather than adverse criticism deserves the commendation which it has generally received. This action aided materially in securing timely assistance for the improvement and extension of this great scheme for "the liberal and practical education of the industrial classes in the several pursuits and professions in life."

One phase of the land-grant college act of 1890 deserves special notice in this connection. The House of Representatives adopted one amendment to the bill as passed by the Senate, by adding to the first section the familiar clause which limits the application of the annuity. ("To be applied only to instruction in," etc.) This has been most erroneously called "the granger amendment," and it has been frequently asserted by high officers of the Order of Patrons of Husbandry, in public addresses and in print, that this amendment was secured in the interest of agricultural education by "The Grange," despite the opposition of "the college presidents," and without this amendment the new Morrill bill could not have been passed. It is to be hoped that these statements have been honestly made and yet it is hard to understand how anyone could be so misled. In every essential particular they are at variance with the truth. History demands a correction of this serious error. With a full knowledge of the facts and personal responsibility in formulating them (which can, however, be verified by ample evidence), I wish to here place the subject accurately on record.

The officers of the National Grange and the National Farmers' Alliance showed an interest in the pending Morrill bill and were freely consulted by the Association committee and invited to attend the public hearings at the Capitol. The Alliance officials cooperated heartily and unreservedly. The Grange officials appeared distrustful, feared the phraseology of the bill was too general, and wanted guaranties as to the use of the proposed new endowment. To show their good faith, and as a wholly voluntary act, the Association representatives proposed this now famous amendment, while the bill was before the Committee on Education of the House of Representatives. I have the original draft of that amendment in my possession; it was first written by one college president who cared more for object than form; was carefully trimmed and punctuated by another college president, and cordially adopted by the others on the committee, none of these being grangers, although entirely friendly to that order and its general work. The Association committee did not believe this amendment necessary, but willingly proposed it and supported it consistently until adopted. The House Committee on Education did not like the amendment and the House itself was inclined to reject it. The slightest intimation or even indifference on the part of its authors and supporters would have led to its rejection and the passage of the bill just as framed by the Senate. Nothing could be further from the truth than the allegation that "the agricultural college presidents" (as the committee was called) were insincere in this matter. They worked faithfully for its adoption when inaction or absence would have caused its defeat. Therefore, instead of this limiting amendment being of Grange origin, opposed by the colleges, and the salvation of the bill, the plain facts are that it originated with college men and had their honest support from first to last, although this actually delayed the passage of the bill. Truth requires it to be stated that the only serious delay and obstruction encountered by the friends of the Morrill Act of 1890 in its progress through Congress, apart from the rivalry of other measures, was the unreasonable suspicion and otherwise unaccountable opposition of the officers and legislative committee of the National Grange.

Of the fifth, sixth, seventh, and eighth conventions of the Association held, respectively, in Washington (August, 1891), New Orleans (November, 1892), Chicago (October, 1893), and Washington again (November, 1894), it is needless to speak in detail. These gatherings resembled the earlier ones, with certain modifications. The number of institutions, and of States and Territories represented, has increased, and year by year more time has been assigned to and used by the sections in the consideration of technical matters of interest to different departments of the colleges and the stations. As a rule, three-fourths of all eligible institutions are represented by delegates at the annual meeting.

It is evident that a large part of the time at every convention must be occupied by the general sessions. The business of the organization for one year must be reviewed and that for the next prepared; now and then there seems to be some waste of time, but less than might be expected and no more than is inevitable, under all the circumstances. Much time has been necessary in the past to consider questions concerning the relations of the institutions to Congress and the Executive Departments, and matters of organization, administration, and accountability. These have been subjects of serious concern, demanding patient and careful attention. Such deliberations have been essential to the existence and usefulness of the organization and have brought it to its present position. As expressed by one of our past presidents, the hundreds of workers in a common cause, who are submitting their labors to the scrutiny of science on the one hand and of practice on the other, and who render an account of their stewardship to the public, round up each year by coming together in convention to discuss the best methods of carrying on this great work. "At such a time, it is impossible not to be impressed with a serious sense of the responsibility of the position occupied by this Association,"[1] and while giving as much attention as possible to technical subjects, the important general questions of organization and unity of action must not be neglected.

The printed proceedings of successive conventions become more and more interesting. Reexamination of these pamphlets impresses one with the value of their contents. The presidential addresses, the annual reports of the chairmen of sections, the business features of the conventions, and the abstracts of discussions in sections, are not only worthy of preservation, but of frequent reference. The reports of the chairmen of the sections, as we have seen to-day, furnish most interesting and valuable epitomies of the yearly progress of the entire work. These pamphlets deserve a place with the historical and technical literature of the colleges and stations, and should be indexed with similar publications.

These pages contain a record of two important pieces of public work carried through under the auspices of this Association, but which can only be mentioned here: (1) The collective exhibit of the agricultural colleges and experiment stations, in cooperation with the United States Department of Agriculture, at the Columbian Exposition of 1893; and (2) the comparative tests of dairy breeds of cattle, also in connection with the great Chicago Exposition. Both were formidable, laborious, and expensive undertakings, but executed with public spirit and most creditable to the Association and the many individuals contributing to this result.

The history and doings of this Association show that it has been eminently a business organization. Its annual gatherings have been working bodies, bent upon systematizing the discharge of the duties intrusted to the associated institutions and increasing the beneficial results of the work as a whole. As instances not yet mentioned of improving methods and securing uniformity, the Association has effectively cooperated, through regular and special committees, with the executive officers of the Departments of the Interior and of Agriculture, in determining the forms of reports required by the Morrill Acts of 1862 and 1890 and the Hatch Act of 1887, and the application and accounting of the respective appropriations and annuities granted by Congress.

The value of the organization as an agency for improving the work, at least so far as the experiment stations are concerned, has been emphatically and formally indorsed by the Department of Agriculture. The attendance of station officers and workers at the annual conventions has been encouraged, the expenses necessary for this purpose have been allowed as proper charges against the "Hatch funds," and the annual contribution of stations to the general expenses of the Association has been specifically approved. Further, these decisions have been officially reviewed and confirmed by the Comptroller of the United States Treasury. This is a most gratifying indorsement of the use which the Association has made of its limited income, as reported from year to year. The proceedings are annually reported, published, and distributed as a bulletin of the Department of Agriculture.

On the college side, the Association has been cordially recognized and its objects and work commended by the highest officials of the Department of the Interior. Although evident that no part of the annuity under the act of 1890 can be used for such purposes, it is admitted by all that contributions to the wants of the Association, and the proper expenses of delegates to these conventions, may be paid from income of the land-grant fund or any miscellaneous receipts of the colleges.

In view of all these facts, it seems strange indeed that any institution, in State or Territory, eligible under our constitution, should refrain from full participation in this Association, and especially from sharing in its very moderate annual expenses. These institutions are beneficiaries of a common foundation, and have like obligations and responsibilities. There can be no doubt that every college and every station has upon several different occasions been directly benefited in money saved, more than anyone has been asked to contribute to the Association since it was organized. The advantages derived from the existence and action of the Association, which can not be measured in money, have been of still greater value. These benefits and advantages, direct and indirect, have been actually received by all alike, whether in affiliation with our organization or not. Every eligible institution must admit that the Association has been its servant and helper, doing things which it needed, better, easier, and cheaper than it could have done them alone. Does any station doubt the direct money value of advance payments of the quarterly allowance, or fail to appreciate the advantages of the liberal construction of the free-mailing privilege? Has any college declined its annuities under the Morrill Act of 1890? Has not every college and station usually represented at the annual conventions felt the benefit derived by itself and by its delegates from their attendance and participation in the proceedings? The only possible answer to these questions seems to plainly indicate a moral obligation on the part of every college and station on the common beneficiary list to become an equal factor in this single recognized and authorized agency for promoting the common cause. It can not be possible that the correct view of this subject has been yet presented to the authorities of the few institutions which do not send delegates nor help support the Association. (It is suggested that there is here a proper field for missionary work, and that the Association may well authorize its executive committee to further endeavor to bring into the fold these few estrays from the flock, who are so backward in coming forward.)

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[1] President Atherton, at third convention.

It will be necessary to explain still further that, for manifest reasons, the constitution of the Association recognizes the college and the station, in every State and Territory, as two institutions, no matter how closely they may be connected, allowing each a voting delegate, and asking an equal annual contribution from the college funds and the station funds.

It is also a singular fact that some of these associate institutions, in full and regular standing, which are particular to fulfill to the letter all the requirements of law, national and State, seem unwilling or negligent in regard to complying with the declared sentiment of the Association in matters not legally defined, but wherein uniformity of action is manifestly desirable. Take, for examples, the general character and form of annual reports and of bulletins, applications to Washington authorities for rulings which will affect others as well as the applicant, and attention to requests made in the name of the Association for its interests. Can not the officers of the colleges and stations, including the governing boards, be convinced that it is expedient not only to recognize this organization as a convenience, but, by common consent, to grant it some measure of authority as a legislative and administrative body concerning matters not regulated by law, nor by national or State officials, and not conflicting with the autonomy of the respective institutions? This would be useless unless all consented to conform to the will of the majority, as expressed at the annual convention.

On a number of different subjects, where the lack of uniformity in action or the probability of variation was seen to be detrimental to common interests, the Association, after proper consideration, declared its opinion by formal resolution or otherwise. The records of such action are scattered through the published proceedings of the successive conventions. In a good many instances, cheerful conformity on the part of the majority has led to a fairly fixed custom; in other cases, the tacit agreement seems to have been forgotten; and in some, little attention was ever paid to the action of the Association. Now, as a step in the direction just indicated, and by way of trial, it is recommended that the executive committee, or a special committee, be authorized by this convention to collect and codify such of these various votes and declarations as may be considered still operative, and report them in print to the next convention, with suggested amendments or modifications. Then let this report be given place as an important item of business in general session, where the several sections of the code (?) may be reaffirmed, revised, or rejected. This done, and the result being promulgated, it can soon be ascertained how far the associated institutions will consent to be governed by the judgment of the majority.

The Association can not realize its full sphere of usefulness until it is empowered to speak with some greater degree of authority for its members and to them, and thus govern, within carefully guarded limits, and always by the consent of those governed.

There can be no doubt of the excellent effect produced by what may be called the declaration of principles as to the Hatch Act, made by the representatives of the beneficiary institutions at the first Washington convention, in October, 1887. It must be remembered that at this time a good many of the land-grant colleges were barely existing upon an income wholly inadequate for the work expected of them. In several cases this new endowment for research considerably exceeded all other resources. There was a sore temptation so to manage the anticipated Hatch funds as to materially increase the college force and facilities for instruction. But the assembled delegates of the colleges about to come into possession of this new income, without division upon any material point, declared most honorable intentions in unmistakable terms. Here is the document, in the form of the adopted report of a special committee appointed to propose to the convention "A system for the organization and management of agricultural experiment stations":

"(1) That all appropriations received under what is known as 'the Hatch bill' should be applied in good faith to agricultural research and experiment and the dissemination of the results thereof among the people, and that any diversion of funds to the general uses of the colleges would be a direct violation of the plain spirit and intent of the law, and an inexcusable disappointment of just public expectation.

"(2) That the experiment stations specially referred to should be so far separate and distinct from the colleges that it shall be possible, at any moment, to show to any authorized inspector or investigator that all the funds derived from the United States under the Hatch bill have been expended solely for the purposes of agricultural experimentation, according to the intent of the law.

"(3) That every department to be known and designated as an agricultural experiment station should be distinctly organized, with its duties and control clearly defined and with a recognized official head, whose time shall be chiefly devoted to this department, who should be on an equal footing with the other heads of departments or professors of the college, and whose compensation should recognize the fact that the duties of the position occupy every month of the year.

"(4) That the publications of the stations should be entirely separate from those of the colleges. The quarterly, or more frequent bulletins, should give their readers the results of experiments as fast as completed, and only as completed or as distinct chapters are completed. These bulletins should enlarge on those practical points, such as the improvement or restoration of soils, the development of plants, and the breeding of stock, when suggested by work done, even to the extent of repeating well-known principles and facts when these need to be taught."

It will do no harm for all to read this declaration again, and it is especially commended to the representatives of institutions established since that time and to whom it may be new. The committee which framed the report,[1] after mature deliberation, was composed of five men who were then or have since been presidents of agricultural colleges, three also directors of experiment stations, and two have been Assistant Secretaries of the Department of Agriculture. The assertion is ventured that this convention, or a still more complete gathering of its kind, would not hesitate, after eight years more of experience, to reaffirm these principles without material change and by almost unanimous vote.

Nevertheless, a decided difference of opinion prevails as to some points apparently settled at that time, and it must be admitted that some of the institutions concerned have not fully complied with the course of procedure then agreed upon.

During the present year an agricultural journal, edited by an ex-director, has sharply arraigned stations for publishing in bulletins matter other than the record of their own investigations. Yet here is this old declaration, ex cathedra, that bulletins should enlarge upon practical points, even to the extent of repeating well-known principles and facts when these need to be taught. The issue of bulletins is obligatory, and there seems to be little doubt that a station may meet this obligation and render valuable service, as some stations certainly have done, by publications in no way related to its own work, or even directly suggested by that or the work of others. Stations do not always find their experiments producing results of value even in a negative way, and the perfunctory record of such work can not reasonably be regarded as diffusing useful and practical agricultural information among the people as well as a chapter on commercial fertilizers, a description of noxious weeds, a statement of the principles of economic feeding, the latest methods in successful dairy practice, or directions for making good roads. Where an exceptionally good piece of work is done by a station in one State which is equally applicable in others, there is a positive public loss in not having this information more widely diffused than it can be done by abstracts which necessarily have a very limited distribution.

Take, for example, a good bulletin upon diseases of the potato, equally applicable and useful in many States. This originates at a station in one State, but it is at the cost of the people in all the States. All should share alike in the benefits of the work. The station system, as a whole, should be developed to reach this stage of broader usefulness. If it can be done by cooperation, very well; but, if necessary, let it be done by law, recognizing that every State has a right to whatever advantage may be derived from prompt information of the work in every other State.

Further, it seems to me that the several stations should contribute, as the results of their operations, the greater part of the Farmers' Bulletins which are now published in such large editions—hundreds of thousands—by the United States Department of Agriculture. This has already been done to some extent, and it is understood to be the policy of the Department to progress in this direction.

The primary purpose of the Hatch Act was undoubtedly provision for research and experiment, but the duty of diffusing information is declared in the same sentence with that of acquiring it. This diffusion involves the function of instruction, although the methods may necessarily differ much from those of the class room and college. What these methods shall be seems to be still a debatable question. A liberal construction of the matter and manner of conveying useful information to the people can not fail to increase the power for good which the stations possess. It is to be hoped that the Association may soon find time to review the whole question of the station bulletin, and that it may at the same time consider, as coordinate means of instruction, participation in farmers' institutes and like meetings and in public agricultural exhibitions. The only time the latter subject ever came before the Association no conclusion was reached. Some stations seem to doubt the propriety of availing themselves of these useful adjuncts, and a declaration by the Association is therefore desirable.

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[1] Messrs. Dabney, Chamberlain, Alvord, Lee, and Willits.

If, as some believe, there was during the early years of the operation of the Hatch Act a tendency on the part of a few of the weaker colleges to lean heavily upon their stations for support, it is charitable to cloak this evidence of poverty by supposing that the instructional function of such stations was first developed; but since the act of 1890 has made the income of every college considerably more than that of its attached station, the last excuse has been removed for any college encroachment upon station funds. Some of the younger institutions have practically no income outside the two annuities under the acts of 1887 and 1890. The special restrictions upon the new Morrill annuity and the greater latitude allowed in the use of the station appropriation make it the more important that care should be exercised and justify this word of warning. There is some danger that where college and station have been established and started at the same time the line of demarcation between the two has not been kept sufficiently distinct. The early declaration of the Association on the subject of scrupulous separation and application of the different funds should be strictly observed. Recent legislation confers full authority upon the Secretary of Agriculture to guard the integrity of station funds granted by Congress. The Association should cordially cooperate in the enforcement of the law.

Those who stoutly maintain the principle of the reserved rights of the States concede that it is not only the privilege but the duty of the Federal Government to follow all moneys leaving the public treasury by act of Congress and provide machinery to insure their application to the objects for which they are appropriated. There is no reason why this system of experiment stations in the several States, largely independent yet subject to the one organic law, should not be as regularly and as thoroughly inspected by Federal officials as the Postal Service, the Indian Service, or the national banks.

It is notable that the institutions assumed at the outset that such inspection would be made, and advised starting the work in such manner as to be always ready for it. And the stations were hardly under way when the Association began, first in 1890, to yearly propose that full authority to supervise station expenditures should be given to the Department of Agriculture. The forms proposed to the Fifty-first and Fifty-second Congresses were much more drastic than the authority finally conferred by the Fifty-third Congress. And the Association at last secured the phraseology which gives force to the whole clause. Prescribing forms for reports and examining returns in an office would do very little good; the command to "ascertain" the facts carries with it, necessarily, the power to inspect and investigate. One can not tell whether the expenditure upon a certain piece of work is right until he sees the work itself, or the results; and judgment of quality as well as quantity is necessary in order to determine the question of value received. As it now stands, the authority of the Department to scrutinize station accounts and enforce the proper application of station funds is broad enough, but none too broad. It should be actively exercised; and this can be done without in the least interfering with that independence of action as to character, plan, and execution of work which is essential to good results and which is assured to every station by the last few lines of the second section of the Hatch Act. It must be admitted that this supervisory power is needed. The station funds have undoubtedly been honestly and efficiently administered as a whole. There has been far less ground for complaint than some have seemed to believe. Cases of waste, incident to inexperience, have been largely outgrown in the progress of the work. Yet there have been a few instances of inexcusable looseness, irregularities, and abuses in the financial management of stations, and these errors have not wholly ceased. With the existing power of correction these few sore spots should be promptly cured. Considering the apparent desire of the Department for this new authority, the tardy and mild manner in which it has been exercised has naturally caused surprise. There seems to be special care lest the feelings of someone should be hurt.

It is said that corporations have no souls, but they certainly have manners and customs. Some behave and some misbehave. Like individuals, corporations are subject to corrections, and as they increase and associate, discipline becomes necessary. In the exercise of discipline errors are repressed and prevented through the force of example. One pronounced case of merited and recognized punishment, so judiciously managed as to be borne on the wings of the wind without any apparent publicity, is, for general and lasting effect, worth a whole host of private admonitions. Despite modern views of the subject, "Spare the rod, spoil the child," is a good old adage, and the point of it lies in its application.

The institutions forming this Association are very closely related, although widely separated. Subject to local control and adaptation, each in its own State or Territory, they still depend upon a common foundation and form a distinct group, which as such must sustain a good reputation with the general public. They are so interdependent that serious mistake, failure, or wrongdoing on the part of any one has an injurious effect upon all. This Association, as the self-constituted representative and guardian of the common interests, has a duty to perform in helping to strengthen the weak spots and raise the general average. Thus far its record is a good one as to both theory and practice. It has not only advocated the wisdom of general supervision and led in securing the needed legislation, but while the authority was in doubt it lent its influence toward accomplishing what could be done by moral suasion. In the only three cases known in which the Department of Agriculture used its advisory powers to lead erring stations to mend their ways, the need of action was first pointed out by officers of the Association, and its representatives were the agents employed by the Department to accomplish the desired ends. The results were satisfactory. Other cases needing attention have been brought to the attention of the Department in like manner, and if equally efficient action has not followed, the Association has at least done its part. The Association officers have in numerous cases called the attention of institutions or their officials to instances of neglect or minor errors which needed looking after, as in the abuse of the free-mailing privilege. Indeed, if the supervisory work of the last few months, the result of which has not yet developed, is excepted, the Association stands away ahead of the Department on the record, as a corrective and disciplinary agent. From the necessities of the situation, the institutions collectively, through the Association, must be their brother's keeper to some extent. Whenever any action is known likely to injure the cause, those cognizant of it should promptly report the facts to the officers of the Association. These officers should notify the proper Government authorities, if the case requires such attention, and should directly or cooperatively do what is possible in the way of remedy. Such a course is not meddlesome; it is in the interest of the common welfare. It is simply a matter of insurance, a sanitary measure, perhaps unpleasant to the individual but necessary for the public health. It may become expedient to give formal recognition of this duty and provide for its execution. There is evidence at times that the censorial function should be lodged somewhere and fearlessly exercised.

At the convention of 1885, and again in 1887, a central agency at the Department of Agriculture was discussed, and this resulted in procuring the means which enabled the Office of Experiment Stations to be established. With all due respect to those who have directed that office, and with a full appreciation of its excellent work, it is still true that it has conspicuously failed, in some respects, to meet the expectations of those who first advocated the need of it. The advisory powers conferred by the first half of section 3 of the Hatch Act might have been more broadly and vigorously exercised, with good effect, and without any assumption of centralized authority. And it was certainly expected that the office would act as an expert critic of the work of the experiment stations—a valuable service, which has been entirely lacking. In the discussion of the Cullen bill at the convention of July, 1885, the president of the oldest agricultural college in the country thus expressed himself on this particular point:

"That bill is weak in one respect. There should be incorporated in it an appropriation of $5,000, to be given to the Commissioner of Agriculture to select some good man to consolidate these reports and arrange them so that we can send them out through the country. Let him have $5,000 to select a brainy man who can take charge of the whole matter; a man who can consolidate, a man who can reason, a man of genius, who can draw conclusions from these reports and can say annually what failures and what successes have been made."

Admitting the difficulties in finding the man described, it is to be regretted that the gentleman quoted did not attempt to put his principles here stated into practice, to some degree at least, during the four years when it was a part of his duty to supervise the working of the Office of Experiment Stations.

This office not only declines to directly discriminate, but in the manner of its reviews and abstracts, in all particulars save quantity or space, it places on a par the good work of one station, the commonplace of another, and the still lower-grade production of a third. A serious degree of responsibility seems to attach to this course. It has the effect of indorsing poor work and tends to its increase and repetition.

The Office of Experiment Stations has grown rapidly in men and means. Would it not come nearer to the ideal adjunct of the stations if more of its time and money were applied to visiting, advising, and criticising, and less to the manufacture of bulletins, which, however well done, is encroaching directly upon a special function of the stations?

Yet this "clearing house" of the stations has done so much good work and become so indispensable that we are again reminded of the need of a similar central agency at Washington, organized and supported by the Government, as an aid to the colleges. The executive committee reports progress in the efforts of the Association in this direction, but no satisfactory results as yet. This work should be revived and vigorously prosecuted. The origin, growth, and usefulness of the Office of Experiment Stations furnish at once illustration and argument which are almost certain to insure ultimate success.

During the last few months a good many of the stations have been visited by representatives of the Department of Agriculture. (Why not call these "visits" by the more significant name of "inspections" at once, that all may become accustomed to the object and recognize its propriety?) The opinion is ventured that the two things which have been and will be found lacking oftener than any other at the stations are good business management and, what is closely related, proper executive control. The Association was sound in its declaration of 1887 as to the station organization. Every station should have its executive officer, and it should be a director who directs. This is as necessary as it is for the college to have a president who presides. This does not mean the annoyance of professors nor interference with scientific workers, nor assumption and irritation anywhere. On the contrary, the capable and energetic executive is a reenforcement, a helper, and base of supplies for every department of college and station, while at the same time he plans, advises, trims, adjusts, and fits all together, so the result is a symmetrical, harmonious whole. The publications of different stations are evidence in point. As those from one station come to hand, one after another, no matter how diverse in authorship and subject, you at once recognize them, the station to which they belong, and the uniformity and finish which characterize the application of editorial skill and executive control. Half a dozen consecutive publications from another station may be handled together without a suggestion of having the same source until closely examined, so diverse are they in appearance and other particulars. The one station is a power; the influence of the other is little felt. The "go as you please" plan is not suited to station management, and I have yet to see a station conducted successfully by a council of administration, unless it also had an executive officer to round out and finish off the proceedings. The concentration in one person of the responsibility for general management almost always results well.

The declaration of 1887 on this point was none too strong. If to be now changed at all, in the light of experience this declaration should be made stronger and more specific.

The union of the duties of college president and station director in one person seems to be expedient only in exceptional cases. Certainly this is bad policy unless that person is wholly relieved from all duties other than those of an executive character. To make a college president also director is equivalent to assigning a president full charge of one of the leading departments of instruction, or rather more than this. In olden times it was expected that the college president would perform the full duties of a professor, but this custom has been found inexpedient, and has largely disappeared. College departments as well as college administration at large have been the gainers. There can be no doubt that station administration is improved where there is a single recognized head responsible for this department in all its affairs, and, of course, subordinate to the president of the institution to which the station is attached. I know that this form of organization is highly favored at Washington, and it may be wise for the Association to declare again its approval of the plan.

Should a similar system of visiting the land-grant colleges be instituted, I apprehend that the point most susceptible of criticism would be the grade of work performed. This would by no means be general, but in a number of cases it would be found that instruction was in progress which could not possibly be regarded as of college grade. Yet no one can read the original Morrill Act and its supplement, and the debates in Congress upon those measures, without being convinced that the intention was to found institutions of college grade, and nothing less. We all know what that means. As the distinguished author of the law has expressed it, "institutions offering courses of study of not less than three years, and preferably four, leading to a degree, as authorized by State law."

It is certain that Congress never intended by land grants or annuities to relieve any State or Territory from the duty of providing its own high schools and grammar schools. The legality of applying the so-called "Morrill funds" to the support of preparatory departments, excepting only "institutions of like character for the education of colored students" (act of 1890, sec. 1), is to be doubted in any case. In a few exceptional instances, the circumstances may justify a land-grant college in making temporary provision for preparing students for its college classes. But the expense of such work should certainly be met from other funds as soon as possible, and the responsibility of public-school service of all grades thrown upon local authorities. The institutions in affiliation with this Association should in all respects be colleges in fact as well as in name.

The more I see of the administration of colleges and experiment stations, the more convinced I am that the one thing which contributes above all others to the smooth movement, successful progress, and effective result of an institution is an experienced man of affairs at the head. The accomplished man of letters, the successful teacher, the accurate student, and the true scientist and investigator are all essential in their places; but an institution may have all these and yet fail from the lack of a capable executive. As a rule, it is easier to fill any other place in a college or station than it is to find just the right man for its head, able to conduct its affairs in a thoroughly businesslike and successful manner.

This Association has done many different things in its conventions and between them. It seems to me that its most valuable feature has been the practical, businesslike way in which its work has been conducted. Even after the "office of land-grant colleges" has been put in successful operation, and the Office of Experiment Stations has been further developed, it is not unlikely that it will be found necessary and prove a piece of true economy for the Association to establish and maintain a regular business agency at the seat of Government for the use and benefit of its members, jointly and severally.

To say that this Association is a necessary adjunct to the colleges and stations but feebly expresses the estimate I place upon the past and present value to the work and the possibilities of its future usefulness. Its operations may be greatly extended, bringing about desirable cooperation and in many ways being of assistance in a business capacity. But its chief end and aim will be to improve the administration of these great trusts, to render more effective the bounty of the people, and to maintain this union, ever ready to meet any emergency. I look for the time when the Association will have a legal status and defined functions and authority, with regular provision for its wants and for periodically bringing a certain part of the workers together as a matter of duty, for the good of the service.

The name of the Association will be jealously guarded in the future, as in the past; used only when the object is worth the effort, always in a good cause, and appealing to intelligence and mature judgment. Thus will be husbanded its reserved power, which can hardly be overestimated, and which will ever be potent in the promotion of higher and technical education and the progress and prosperity of American agriculture.

I can not close without again assuring the associated institutions, through the delegates here assembled, of my full appreciation of the kindness so long shown to me personally, and particularly for the honor conferred upon me the present year. The latter is especially gratifying, as this is likely to be, much to my regret, the end of my active participation in these notable, profitable, and enjoyable conventions.

Mr. White. I desire to offer the following resolutions, which, I am sure, will receive the support of all present:

Resolved, That the Association returns thanks to Professor Alvord for his valuable and interesting address, and orders its publication in the proceedings.

Resolved, That the president's address be referred to a special committee of five, to be appointed by the presiding vice-president, with instructions to report to the Association, during the present session, resolutions embodying such action as may be desirable upon the suggestions therein contained.

The Presiding Officer. You have heard the resolutions offered by Mr. White. Are you ready for the question?

Upon vote, the convention adopted the resolutions as read.

The Presiding Officer. The Chair will now appoint the committee of three to whom was referred that part of the report of the executive committee touching upon the matter of compensation for post-offices that handle large amounts of the bulletins and other franked mail matter of the experiment stations. I will name as that committee Messrs. Redding, Myers, and True.

I will name as the committee requiring appointment in the resolution just passed Messrs. White, Flagg, Bryan, Armsby, and Schweitzer.

Now, by the programme already adopted by the Association this morning, the hour has expired for this meeting; and at 9 o'clock this evening the meetings of the Sections on College Work, Horticulture and Botany, and Entomology will convene.

Mr. NORTHROP. I beg your indulgence just a moment, in view of the fact that I shall be obliged to leave the hall before the convention closes. I have not had an opportunity to confer with my associates, but I rise simply for the purpose of saying that it would give us in Minnesota very great pleasure to have the convention of this organization meet with us, and I extend to this convention a most cordial invitation to meet at Minneapolis next year. I suppose it is highly probable that the National Educational Convention will, under the circumstances, meet at Duluth, and it will be possible to obtain rates the same as that organization for our convention, if held at Minneapolis. I can only say, sir, that we will do everything in our power to make it pleasant for you, and I think it will be profitable for the Association to see our station and see our work; not that we will be able to instruct you, sir, but that it may be profitable to see the way in which the work is carried on at our Minnesota station. I recognize the fact that I am not in order in making this application at this time, but I am sure the convention will pardon me for speaking, under the circumstances, and I hope that our invitation will be welcomed as heartily as it is given by us.

Mr. GOODELL. Mr. President, I move that we do now adjourn.

Carried.

MORNING SESSION, WEDNESDAY, JULY 17, 1895.

Convention called to order at 9.30 a. m. by President Henry E. Alvord.

The CHAIRMAN. As unfinished business from yesterday morning's session, we will now call for the report from the chairman of the Section on College Work.

Mr. Connell presented the following report:

REPORT OF THE SECTION ON COLLEGE WORK.

MR. CHAIRMAN AND GENTLEMEN OF THE CONVENTION: I was given notice about the middle of June that the duties of chairman of the Section on College Work would fall to my lot as vice-chairman of that section. As soon as possible I set about sending out a circular letter of inquiry to the president of each college, asking that a report of progress upon certain points be made at his earliest convenience. Unfortunately some of these inquiries were received after summer vacations had begun, and it was impossible to give full and satisfactory replies to all of the questions propounded. We are fortunate in having fairly complete reports from the States of Maine, Montana, Colorado, Wisconsin, Idaho, Rhode Island, Arkansas, Pennsylvania, Tennessee, New York, Massachusetts, New Mexico, Florida, Minnesota, Kentucky, Maryland, Wyoming, Oklahoma, and Texas. These institutions have presented some important information concerning the methods of their work and courses of study, the number of instructors employed in several departments, the number of graduates in various courses, the success of graduates as farmers and mechanics, the additional cost of equipment added during the past year, etc. Time will not permit the reading of the questions which were submitted to the various institutions, but I beg leave to call your attention in another portion of this report to a few of the more important questions and replies that go to make up the systematized answers from the 20 colleges replying.

In the reports from the 20 institutions it is interesting to note that more than $75,000 has been spent in permanent equipment during the past year. Massachusetts reports the maximum for any one institution ($13,000), while several report no greater expenditure than $2,000. We would judge from this that the colleges are making steady progress and are adding materially to their permanent equipment.

Information was sought as to what important changes in curricula had been made. I note a few of the answers which indicate the greatest progress along this line. Maine, "Entire rearrangement of both agricultural and mechanical courses." Montana, "Short two years' agricultural course and more shop work added in mechanical course." New Mexico, "Less farm work in lower class and increase in farm work and study in higher classes. An increase in shop work, English history, and languages." Minnesota, "The dairy school enlarged, department of domestic economy for women added, special course in mechanics and physics added." Kentucky, "Some additional studies in electrical line, and more physical laboratory work." Other changes of more or less importance are reported from several States.

The constant tendency to increase the number of instructors in agriculture and mechanics in the various colleges indicates that these two subjects are receiving much more attention than formerly. The question was asked: "What addition has been made to faculty or force of instruction in agricultural department, mechanical department, and other lines of instruction?" Maine reports having added 3 instructors in agriculture and 2 in mechanic arts. Wisconsin, 1 in agriculture. Idaho, 1 in mechanics, other departments 1. Rhode Island, agriculture 2, mechanics 4, other departments 2. Arkansas, other departments 4. Massachusetts, agriculture 1. New Mexico, 2 substation superintendents, other departments 2. Minnesota, mechanics 1, several instructors in other departments. Maryland, mechanics 1, in other departments 3. Oklahoma, other departments 2. Texas, 1 new substation superintendent.

The answers to the inquiry for the "number of officers now employed in the agricultural department, mechanical department, and natural sciences" show that of the institutions reporting the departments are equipped with the following force of salaried men: Agriculture averages 6.3 men; mechanic arts average 5.8 men per institution. The natural sciences (upon the average) are equipped with 5.5 men. Of course, in some of the institutions the agricultural or the mechanical department is entirely lacking, but this is true in but four cases reported. The greatest number of men serving any agricultural department, as reported, was 35 from Cornell (N. Y.), while 20 are employed in Wisconsin and 16 in Minnesota. The greatest number of men serving in the mechanical department of any institution is 45 at Cornell, 15 in Minnesota, and 8 in Rhode Island. The greatest number of men serving in natural science departments was reported to be 18 from Minnesota, 10 from Rhode Island, and 6 from Wyoming.

It has for a long time been a question with this Association, "How can the students of the lower classes be induced to undertake the last two years' work of the four-year B. S. course?" Statistics from various States show that in but a few of our colleges does a satisfactory number of freshmen graduate in agriculture or mechanic arts. In seeking information upon this subject, Maine reported to your chairman that 90 per cent of the students spending two years in that college graduated. Massachusetts stated that 80 to 90 per cent of such students graduated. Minnesota reported that nearly all of the agricultural students who remain two years finish the four-year course, and 70 per cent of the mechanic art students in this class graduate. Would it not be interesting to learn from the representatives of those colleges just how they make their work so strongly attractive that students complete the work of four years if it has only been well begun? Would it not also be interesting to learn the conditions which permit the colleges of Maine, Massachusetts, Colorado, Wisconsin, Rhode Island, Minnesota, and Maryland to employ more than 90 per cent of their graduates in agriculture and mechanic arts in those particular callings? It is very likely true that there are local conditions of one or more kinds that assist them in reaching this highly desirable percentage; nevertheless it is evident that there is something peculiarly strong in their curricula, methods, or men which produces such satisfactory results.

In seeking for information as to the prevailing customs of our military feature in all of the colleges of this country, it was developed that the States of Idaho, Pennsylvania, and Tennessee excuse senior and junior classes from drill. Kentucky excuses her senior class. Some interesting information was obtained concerning uniforms worn by the students of our several colleges. The price varies from $10 to $20 for complete suits. A fair idea was gained of the number of hours devoted to drill in each institution. It is noticeable that where no barracks or dormitory privileges are had the time given to drill and other military exercises is often perceptibly increased. This is no doubt largely due to the air of military discipline, which strongly pervades all of our land-grant college student bodies where "barracks" are used. The presence day and night of a superior officer, surrounded by military setting, the guard duty daily, marching to and from meals, usurp the place of much of the time given to drill in other institutions where barracks are not had.

The fourth question asked was, "What has been done to increase the number of students taking the agricultural course in your institution?" I append all replies given to this.

Montana, a short course added; Colorado, nothing; Wisconsin, by short courses we have brought up attendance to over 200 students; Idaho, only preparatory work attempted in agriculture; Rhode Island, nothing; Arkansas, prizes of different kinds for practical work, and prizes for essays; Pennsylvania, a farm home has been provided agricultural students; Tennessee, nothing unusual; New Mexico, everything we know how to do; Florida, greater emphasis has been put upon the course, improvements have been made; Minnesota, a school of practical agriculture has been established and is very popular; Maryland, whole influence so directed; Wyoming, general improvement of facilities; Oklahoma, nothing; Texas, paid-student labor system in operation and improvements in course of study.

I believe it will be interesting to note in this connection the active part taken by the colleges here reporting in the work of instructing farmers in their several States by active participation in institute work, by use of instructive exhibits at fairs, and by acting as bureaus of agricultural information. It is pleasant to note that each college without exception does institute work in its State where there are institutions. The Maine college and the Montana college participated largely in fairs and institutes in those States last year. Colorado college reports all farmers' institutes attended and exhibits made at fairs; Wisconsin, all institute work is under control of the college; Idaho, the college has led the way in such organizations; Rhode Island has done all that was possible; Arkansas reports 4 institutes attended last year; Pennsylvania sends one or more of the staff to such meetings, expenses paid by station; Tennessee college gives annually 50 lectures throughout the State; Massachusetts college attended 24 institutes last year; New Mexico college takes part in the Territory fair; Florida college takes part in the few meetings held in that State; Minnesota college originated the institutes and frequently participates in them; Kentucky occasionally exhibits at fairs, State agricultural meetings attended; Maryland college represented at all fairs; Oklahoma college attends all institutes and fairs; Texas attends farmers' institutes frequently, no attendance on fairs.

From the foregoing we must conclude that the colleges in the several States are active agencies for the upbuilding of agricultural interests by their institute work, by exhibits at fairs, and by acting as bureaus for the dissemination of agricultural information in their respective States.

Allow me to briefly call your attention to the results of an inquiry which was put to learn the proportional amounts of time given to class-room instruction of students taking the agricultural course, (1) as to scientific agriculture in class rooms, (2) as to practical agriculture out of class rooms, and (3) as to scientific laboratory work.

The average number of hours per year (in the four-years' course) devoted to the study of agriculture in the section room by the colleges reporting is about 120 hours, the maximum being 198 hours. For agricultural work out of the class room the average for the year is about 150 hours, the maximum being 600 in Pennsylvania. The average number of hours for scientific laboratory work is about 180 hours for the year; the maximum reported is 240 hours in the Montana college. Correspondingly, the instruction in mechanic arts in the class room amounts to about 150 hours' average per annum. Their work out of the class room is 200 hours' average per annum. The work of mechanic art students in laboratory, with few exceptions, does not run over eighty hours per annum. Upon the whole, it would appear that students of mechanic arts do not receive as many hours scientific instruction annually in the colleges reporting as do the agricultural students, but obtain more technical industrial training.

One of the questions asked was, "What are the results of your efforts to procure employment for your graduates in the mechanical course?" I append some of the answers received:

Maine, entirely satisfactory; Colorado, they obtained places readily; Idaho, nothing has been done; Arkansas, graduates are almost all employed; Tennessee, a large per cent find positions; Florida, very good; Minnesota, secure employment without effort on our part; Kentucky, nearly all secure employment; Maryland, no graduates, work just begun; Oklahoma, no mechanical department; Texas, no special efforts, results satisfactory.

It has been suggested at some former conventions of this Association that it would probably be advisable (in the near future) to provide some systematic means for the employment of the graduates of our colleges, but should the success of the colleges here reporting upon this subject be taken as an index of the experience of all our colleges, such a step, for the present at least, is unnecessary.

No doubt it is largely through this organization that so much of uniformity in methods and results have been obtained. A report similar to this in some respects made to this body will not only mark something of the progress of our colleges but will afford opportunity by comparisons for each to measure up to the standard of the very best in certain essential features.

The CHAIRMAN. We also laid over yesterday reports from special committees of the Association. Are any of the committees appointed at the present convention ready to report?

Mr. BURRILL. Mr. President and members of the Association, your committee appointed to prepare a statement concerning the life and services to agriculture of Dr. Norton S. Townsend, just deceased, beg leave to present the following brief report:

Dr. Townsend came to mature manhood upon his father's farm in northern Ohio, and, though he then chose as a profession the practice of medicine, he never lost his first love for agricultural sciences and pursuits. Such was his ability and energy that he became prominent in various lines of activity as a citizen of his adopted State, and he held at different times high and important offices in the State and in the nation.

But as we knew him, he was especially preeminent as a teacher and worker in agriculture. In association with the late Dr. J. P. Kirtland he established, in 1854, the first school in America in which instruction in agricultural topics was made a leading feature. He may, therefore, be termed the first professor of agriculture in the country, though others held the formal title earlier than he did.

Onward from the date mentioned he was continuously connected with agricultural organizations and instruction; a member, and, at a critical time, president of the State board of agriculture; one of the first board of trustees of the State University of Ohio, and continuously an honored member of the faculty of that institution from the time of its organization until his death.

He was several times a delegate to the meetings of this Association, and was known to us all, at least by reputation, as a successful worker in the specialties of this organization, and as a man of wide attainments and great executive ability.

His broad humanity and abiding interest in his fellow-man were as conspicuous as was his professional eminence.

On all sides he was one of nature's noblemen. He died, after a very short illness, on the 13th of the present month, and was laid to rest upon the day of our assembling—the 16th.

We recommend that this report be entered upon the minutes of this meeting of our Association, and that a copy thereof be forwarded to the family of our deceased brother.

T. J. Burrill,
L. B. Wing,
W. W. Cooke,
Committee.

On motion of Mr. Hunt the report was adopted.

The Chairman. Are there any other committees ready to report? If not, then the order is general business. We now have the consideration of the proposed amendment to the constitution as the next on the order of business.

Mr. Goodell. I understand that a letter has been received from the mover of the resolution, which you will find incorporated in the general programme. I will call for the reading of that letter by the secretary.

The secretary then read that portion of a letter from President R. W. Silvester referring to the proposed amendment to the constitution introduced by him at the Washington convention in 1894, and expressing the wish that the consideration of the resolution might be deferred till the next convention.

Mr. Goodell. In accordance with the request of the introducer of this resolution, I move that this amendment to the constitution be laid on the table.

After some discussion the motion to lay on the table prevailed.

The Chairman. The Chair desires to notify members that this question must be reintroduced upon the programme for next year if it is to be considered at the next annual meeting. The next order of business, according to our programme adopted yesterday, in this morning's session is "Discussion of Methods of Instruction in Teaching Agriculture." This discussion will be opened by Mr. Thomas F. Hunt.

Mr. Hunt then presented his paper, entitled

Methods of Instruction in Teaching Agriculture.

I trust that an examination of the programme will convince you that I have been chosen to open this discussion on the theory that in battle the junior officer is sent first. I must necessarily be brief and I trust you will understand that in referring to the work of the department with which I am connected, as I must do, I do not do so for the purpose of parading the work of that department, but because it is the work with which I am familiar, and it is the only experience that I could give which would be of value. I have not had time since being notified, even had it been expected, to collate the work of other institutions.

I have no theories with regard to methods of instruction in agriculture. As Miss Lydia Hunt, superintendent of Indian schools, San Carlos, Ariz., said last week with regard to the Indians, I believe in doing the best you can under the circumstances.

Two agricultural college men fell to talking about two institutions. One said, "I do not understand how it is that the university has so many students in regular courses in agriculture. University A has splendid facilities and excellent specialists, in both respects superior to University B, and yet has practically no students except in the short winter courses." The other person replied, "There are probably several reasons, but the following seems to me an important one: University A teaches that it is a good thing to have a good education, but a much more important one to make good butter. University B constantly holds before its students the idea that it is a splendid thing to be a good butter maker, but much more important to be an educated man." This is not quoted to discuss the propositions involved, but to emphasize the fact that in my own teaching and in this discussion I keep the latter proposition prominently in mind. My attempt is to train as well as to inform, to give power as well as knowledge, to make men as well as educated farmers.

While I am unalterably committed to instruction in technical agriculture, I would prefer a man well educated in Greek to conduct a farm for me to a man poorly educated in agriculture.

The method of instruction in agriculture depends largely upon the previous training of the student. Twenty-five to thirty students in the agricultural courses of the Ohio State University take forging and woodwork in the mechanical department each winter. These students possibly constitute one-fifth of the students that take this work, the rest being mostly from the engineering courses. The director of the industrial department and the instructor in the forge shop are emphatic in their statements that the agricultural students do more and better work in the same time than any other students who come to them for instruction.

On the other hand, when we consult the instructors in mathematics and physics, we find that as a class the agricultural students do less work in a given time than their neighbors. Without making too much of this, I think it is clear that the previous training of the agricultural student has taught him to do much more proficiently than to think. It is not necessary in this audience to insist that students be taught both to do and to think; not only because in after life they must both do and think, but because the two faculties assist one another and make each more proficient and accurate. To my mind, however, our methods of instruction should recognize that the agricultural student needs especially to be trained into habits of thought. For this reason I prefer poor text-books even to good courses of lectures. Most of the students who come to me for instruction have had at least one year's training in the institution before entering my classes, yet I prefer as far as possible to assign definite daily lessons, to be prepared either from text-books or library references, or by the giving of special problems to be worked out. I like to get these students upon their feet in the recitation room and tell what they have learned. If I wish to add anything to what they have found in the text-book or elsewhere, I prefer to do it by asking them questions which will enable them to think it out. I am aware this is considered old-fashioned, and is no longer popular as a university method. I believe, however, that such a method, followed systematically and consecutively three to five days each week, week after week for nine months, will produce a growth in your student which is substantial and lasting and quite as rapid for this class of students as any other. With seniors and advanced students, they may be profitably thrown somewhat more upon their own resources, and here lectures and seminary methods may be profitably employed.

Methods of instruction are modified by the fact that it is not desirable to teach students that which they know already. We may for this reason teach students to judge cows, but not to milk them. By growing small plats for the purpose we may teach students to judge of the character and value of varieties of corn, but generally speaking, it would be wasting their time to teach them to plant or to husk it. We may teach students the manual operation of butter and cheese making, of the laying of tile drain, of budding and grafting, but, speaking generally, not those of plowing, sowing, or harvesting.

The methods of instruction are, like the pleasures of Colorado tourists, largely modified by the weather. I believe I could arrange a practicum for one-half day each week in the year which would be of distinct value. These practicums, however, must be held at definite and regular times to fit the university schedule. Indeed, if there was no university schedule they should be regular and systematic. If reflection does not convince you that this is impracticable in any country where it rains on an average one day out of three, try it.

Agriculture is a comprehensive term, and the method of instruction will depend upon whether the instruction is on farm equipment, soil physics, farm crops, stock breeding, stock feeding, butter making, or rural economics. The best way to learn to judge live stock is to judge them. The best way to get a clear understanding of the history of agriculture is by reading and reflection.

It is with considerable hesitation and trepidation that I have brought with me some illustrations of the methods employed in teaching agriculture. The crudeness of these attempts will certainly shield me from the charge of egotism. I know of no other way in which we can get at some common ground along specific lines of instruction. Here, for example, are a set of student score cards and report cards on the subject of animal mechanism, stock judging, butter and cheese making, similar and in some cases identical with those used by other institutions. There is nothing original about these, but some of you who are not familiar with them may be interested and perhaps benefited. (Student's work in soil physics, in planning farms and farm buildings, in rural economics, and descriptions and researches in cultivated grasses were here shown.)

In fact, the besetting sin of agricultural education has been, in my judgment, its originality. Every instructor has prided himself on his own methods. The instructors of agriculture, instead of consulting together and formulating systematic methods that they might become a drilled army of workers, have remained isolated, and to this day know little of each other's work in teaching. In experimentation it is quite different. Instead of being a drilled army working along definite lines, the aggregation reminds one of nothing more than the curiosities which frequently travel from place to place and are exhibited under canvas for a 50-cent admission. Nothing is more needed than a classification of the subjects to be taught, the amount of time to be devoted to each, and the methods to be employed. For example, the following are definite branches of instruction in agriculture, viz, farm equipment, soils and soil physics, farm crops, rural economics, history of agriculture, breeds of live stock (which may include animal mechanism and judging), stock breeding, stock feeding, butter making, and cheese making. In a four-year B. S. course in agriculture, how much time should be given to each of these subjects, and how much time should be devoted to laboratory and practical work? These are questions which some committee of this Association should consider and determine. It would probably take several years and considerable hard work for a committee to formulate a schedule that would be satisfactory, and it would take a good many years for the several institutions to adjust themselves to this schedule, but the importance of the result makes the attempt desirable, for the subject of agriculture will never have the standing in our American colleges and universities that it should have until this is done. In language, mathematics, and some of the sciences, the amount, the method, and the place of the several branches of the subject in the curriculum, and the preparation necessary before entering upon them is well recognized by educated people. We should work toward a similar result in agriculture. A beginning must be made before the end can be reached.

The CHAIRMAN. General discussion will be postponed until the end of the presentation of papers.

Mr. WHEELER. I would like to ask why it is that the men who study agriculture can not think, or that the men who study mathematical problems choose the mechanical course?

Mr. HUNT. In my judgment, those students who take the agricultural courses are farm boys who have been trained to *do* rather than to *think*, and this is the thing that they take to and the thing that, relatively, we need to lay least stress on. They know pretty well how to *do;* now, what we want to do is to coordinate their studies.

Mr. W. M. Hays presented the second paper upon the topic "Methods of Instruction in Teaching Agriculture."

In some colleges the term professor of agriculture has become well-nigh obsolete in the much subdivision of the work into specialties. Professors of horticulture, botany, entomology, agricultural chemistry, dairy chemistry, agricultural physics, bacteriology, mycology, dairy husbandry, animal husbandry, and other more or less clearly defined lines have developed as offshoots from the original comprehensive chair, and the subdivision can go a long way yet and still leave ample fields for each specialty. With only farm management and crops as my specialty, and the ability to work twelve hours daily, I must either subdivide my work or use assistants to meet the demands of over 300 agricultural students.

Our school of agriculture, virtually an agricultural high school, our dairy school, and our agricultural school for women have led all our teachers into making their work concrete and practical, and have laid a foundation for scientific work in the college course, the students of which have received the equivalent of a two years' agricultural high school preparation. Most of us shrank from teaching students two years in the school of agriculture and then taking them forward in the same studies in the college course, but it only makes it necessary for each professor to build up the methods and matter of our instruction to meet the demand, and each teacher is becoming the stronger for it. The most important feature of our instruction is that we have arranged a high school for boys and girls who are going to continue in the farm life, and very few besides those who wish to enter professional agricultural lines are choosing to proceed with the four years' college course, which has over two hundred hours more of scientific recitation and laboratory work than any other scientific course in our university.

I divide the instruction given by myself in the school of agriculture into three terms' work of twenty-five to sixty lessons each. In the first term something is given of the great sheet of geological drift with which our State is covered. Drainage is taken up in lectures, and illustrated in the fields, and practice is given in laying tile drains. Enough of soil physics is taught to give some knowledge of the movements of water in soils, and the general facts regarding cultivation. The physical condition of the soil is followed from the turning of the native sod, and backsetting, dragging, pulverizing, rolling, methods of planting, intercultural tillage, stubble plowing, and fallowing are all discussed in relation to the mechanical condition of the soil to weed eradication and to profits. Road building and repairing are taught by means of lectures, models, observation, charts, and even some practice is given with some of the modern road machinery. Fence building is also taught, as are farm planning or laying out farms, and each student is required to do some drafting and observing of farms.

During the term following I assist in the drawing class, where our architect teaches the planning and drafting of farm buildings. Here each student presents a plan of his father's or his own farm, made during the holiday vacation. If the erection of a barn or other building is contemplated by the owner of the farm the details of what is wanted are brought to the drafting room, and the building is located on the student's plat of farm, and together the teacher and student work out a practical building, and the student makes working drawings. Should no buildings be needed at home it is easily assumed that one or more have been burned and plans for a new one must be made. This line has proved very interesting and valuable to students. In one term of general drafting and one term in drafting buildings the young men gain an ability with the use of the pencil and confidence in it.

The second term's work is devoted to grains, grass, and other forage crops, roots, and to weeds. Our school of agriculture being of necessity in session in winter, when our farm boys can attend and still retain their place in the farm work, we are at a disadvantage in giving practice. This work is, of necessity, done mostly by means of lectures. Reading and even some text-book work are required, and each student writes papers, the best of which are read to the class. Bundles of field crops and of weeds are preserved, and the students are required to make themselves botanically familiar with them by dissecting them. Each crop is discussed in detail, the entire method of cultivation being reviewed, and illustrations are given, where practicable, of operations. We need and have planned for this purpose an indoor garden floor, where many things may be illustrated in the ground. While we are in a great machine-using State, we have difficulty in giving laboratory practice in field and garden work to our school of agriculture boys. I hope others will discuss this part of the subject.

In the third term, jointly with Professor Snyder, our chemist, I discuss the management of fields and their fertility, though the major part of the work is left to him.

Our professor of animal husbandry, Professor Shaw, divides his live-stock instruction into breeding, breeds, and feeds. He makes it a strong point to train the eye, and even the hand, on types, and in the judgment of individuality, usually having one or more specimens before the class, when talking of breeds and breeding, and sometimes in lectures on feeding. The amphitheater lecture room, with an area for animals, is a necessity, and our many students demand that we keep a large number of specimens for illustration. Professor Haecker, who is present, trains the students to size up the digestive and lacteal departments of the cow, and then turns the student's attention to the fact that he wants as little cow besides as is decent. By repeatedly passing judgment on cows, they learn the meaning of the ruffed and fluted spine, the sweenied crops, the attenuated neck, and the cat hams of the dairy cow, which gets so much internal exercise in making milk that she is much less liable to contract tuberculosis than the round, fat, indolent beef animal that does no work and is restrained from her natural exercise. It is constant practice that trains the boy's eye and builds up in his mind the revolutionary ideas of the professor. Studying such noble forms as the cow's is considered worthy of long time by the sculptor or painter, and how can we breed animals without long eye and mind practice? It is as easy to learn Greek in six easy lessons as to learn the arts of agriculture at one sitting of a farmers' institute. In feeding the dairy cow Professor Haecker does most of the work in the class room, and if anyone can tell him how to give laboratory practice and not lower the records of his pet cows I am sure he will be thankful.

Dairy manufacturing is taught to all our farm boys and farm girls by a series of lectures, and enough practice so that each student can learn how to make good butter or good cheese, as the case may be. In this work it is practicable to give an abundance of laboratory work of a clean-cut kind, that enables each student to take up the dairying successfully at home. Besides the care of milk, the creaming and care of cream, the churning and packing of butter, and the making and curing of several kinds of cheese, of course each student gets also the supporting work in testing milk, and the chemistry and physics related thereto. But the practical part, that will give the farm-school student when he gets home the grip on the business, is the practice, continued till there is no longer luck but certainty in his operations. We need to give these practical things plenty of time. The boys enjoy the practice.

Our meat house, erected a year ago, has proven a very valuable feature, and in it my foreman, Mr. Boss, has developed a practical line of instruction, which is of great interest and profit to the students. The students are taken in groups of about five; each group manages the meat house for a week at a time. The dormitory and the professors' tables are furnished with meats, which Mr. Boss purchases of the station or of outside parties, sometimes feeding for a short time, and sells at cost. The groups of students kill and dress the cattle, sheep, swine, and poultry for about 300 people, usually doing this work on the weekly holiday. They meet in the cutting room of the meat house daily, and, under the instructor, with charts at hand, fill the orders for the day. The instructor talks to each group of boys and, besides, gives a number of lectures to the class. Instruction and practice are given in the making of wursts, sausages, etc., and in preserving meats. Here also is taught some physiology, and many of the lessons of conformation in the breeding and feeding classes are here illustrated by inspecting the live animal and its carcass, in whole and in parts.

In our four years' course for college students all of whom have taken the course in the school of agriculture, we offer to juniors and seniors twenty-two subjects directly relating to agriculture, and of these the student must elect at least twelve, or one-fourth of the entire course. The professors of agriculture, animal husbandry, and dairy husbandry each offer two or three terms, and the other heads of divisions in the experiment station, all together comprising the special faculty of the college of agriculture, offer the rest. This work is being reduced to system, and thorough work is required, though the method of instruction is much after the style of post-graduate work. This is becoming the most enjoyable part of our work, and some of it can be done in connection with experiments. Preliminary experiments may often be done with this class of student labor, and the students learn much of methods, and especially of the importance of care, honesty, patience, and of well-defined plans in experimental research. These students learn by practice how to independently study subjects, as distinct from books, and are required to prepare papers and perform work of a laboratory nature, rather than hear lectures. Our school of agriculture gets less of literary education than students who come from high schools of the State, but it is recognized in the university that these young men have a practical training to think as well as to do. Each of the half dozen professors making up the special faculty of the college of agriculture at the experiment farm is developing a scheme of studies for college-course students. Our agricultural chemist, for example, offers five or six terms' work after the two terms given in the school of agriculture.

Having the two distinct courses, as we now have, makes the classification of our work more difficult, in that some of the subjects covered in the college course are taught in the agricultural high-school course; but when once finished the classification will be more complete, because of the greater number of terms into which the subjects may be divided. Two of three terms offered to the college students in my line are designated field agriculture and rural economics. The professor of animal husbandry naturally divides his subjects, much the same as in the school course, under breeding and feeding animals. The professor of dairying has each student take up certain lines of dairy study and research, and, now that a class of several are starting into the college course with a view to specializing in dairy science, he will need to work them in groups or classes.

We make farmers in our high-school course, and professional agricultural workers in our college course. On the side, we educate a lot of factory dairymen, and for the farmers we train a lot of wives who know cooking, dairying, sewing, gardening, fruit raising, and home making, as a class of farm women never knew these things before. Our farmers' institutes are a power to send us students and to arouse our farmers to hunger after knowledge, as well as to teach them technical agriculture.

I can not refrain, in passing, from saying that our State agricultural, horticultural, dairy, and other like associations are in line and speeding forward the good work, and our agricultural press is a power in our land.

The CHAIRMAN. The next gentleman designated to continue the discussion of this subject is Prof. W. W. Cooke.

Mr. COOKE. In the ten minutes allowed me for continuing this discussion, I wish to present the phase of it brought to our attention during the discussion in the College Section of "What studies should be embraced in the four-year B. S. course," in which you have the whole time of the student, forenoon and afternoon and evening if you want it, for two years, to be devoted principally to agricultural work. That is not the problem that is presented to us in a large part of the colleges of the United States. We have coming to us a class of men who say they want to take an agricultural course—the four years' agricultural course. Now, shall we undertake to teach them straight agriculture for four years, or shall we try to make of them well-educated men with, in addition, some theoretical and practical work in agriculture? There have always been two classes at variance in answering this question. When the agricultural college first started, thirty years ago, the idea in the minds of a good many at least of those who favored the proposition was what we call a farm school. It was subject to a great deal of criticism. I hope and believe that the agricultural college has gotten far enough along in its course to justify its existence without being a farm school; to justify its existence in giving agricultural students a good all-round general education. Now, what is meant at the present time by a good all-round education? It covers a multitude of topics, and there is much difference of opinion as to what studies ought to be taught. We have just heard from the last speaker how they took twelve terms of agriculture during the four years' course. I think that is just about the average at the present time. We have heard what he says, in addition to that contention of those specialists in agriculture who want to give an additional two, three, or five terms of work to the student; and the field is so large that I do not know how we are going to adjust the pressure from the two sides. But this much has been brought out very clearly by the work and experience of the different colleges, that we shall have to give up the idea of manual training in agriculture, in its pure sense of cultivating the soil, in a four years' course. We have got to confine our work; concentrate it into the class room, instead of spreading it over a large amount of work that must necessarily be to a large extent a repetition of what the student has learned before he comes to the college. There are certain phases of it that are still capable of being taught by the hand. Dairying is perhaps the best example we have, and to a large extent we can teach the feeding and breeding of animals; but there is so much to be crammed into the student in that four years that we have got to do almost the whole of it in the class-room work; and that professor of agriculture does the best who has most learned to concentrate that work, to teach his student to think, to exercise his mind, at the same time that he is pouring into that mind the information of technical agriculture.

The CHAIRMAN. This question is now open for discussion. It would appear that about twelve minutes remain to consider this subject.

Mr. TRUE. Just a word on this subject from the standpoint of one who has never taught agriculture, but who has had considerable experience in teaching, and has made something of a study of methods of teaching. I believe Professor Hunt struck the root of the matter in one or two things which he said. It seems to me that in agriculture, as in other subjects, the college professor has given too little attention to his work as a teacher. If he will devote himself to the work of teaching—to the methods of teaching—I believe that he will be able to develop a course in agriculture which will be along the right line. The other point is, that agriculture as a department of college instruction needs to be more carefully defined, as Professor Hunt said, and the subject-matters to be taught and topics to be selected should be very carefully considered. It is along these two lines, the consideration of methods of teaching and the careful selection of topics to be taught, that we are to work out a proper course of instruction in agriculture, as in other subjects that are taught in our colleges.

Mr. CLUTE. In the meeting in Washington last held there, Mr. Harris, of the Bureau of Education, in a very learned talk, said that in his observation of methods of teaching, the subjects of agriculture and horticulture had not yet been reduced to pedagogic form. This morning, as I listened to Professors Hunt and Hays, it seemed to me that at least those gentlemen were reducing the subject of agriculture to pedagogic form. They are mapping out definite lines of work and are showing just how that work may be done in the hands of the clear-headed agriculturist and teacher. I was very much interested in the remarks made by those gentlemen. It would seem that the laboratory side of agricultural work is, in their hands, and I hope in the hands of others, being so carefully elaborated that we shall have these as precedents to guide the various departments of agriculture throughout the country. It strikes me that while there may be a very large amount of valuable work for their students in chemistry, in physics, and in some of the other sciences, the laboratory work is so directed that the minds of the students are at once aroused. In the course of the discussion here, as regards mechanic arts, the students become immensely interested because they have laboratory work with the machinery and tools, and they are able to accomplish something by the aid of those tools. Now, formerly in agricultural and horticultural colleges, the laboratory methods have been often meager; there has been nothing of interest or beauty to attract students in those directions. But in the last few years, especially under the leadership of such men as Professors Hays and Hunt, these laboratory methods are being thought out. And there is another, too, in the dairy school, the school of horticulture, as outlined by Professor Hays, and various methods of that kind. This whole subject is getting into such form that we may hope very soon that the criticism of Dr. Harris that the methods of teaching agriculture and horticulture have not been reduced to pedagogic form will no longer apply to those branches. Now, just one word further as regards the subject of manual training. I do not regard it an essential to introduce very much of manual training into the course of instruction in agriculture and horticulture; but it seems to me, Mr. Chairman, that what the laboratory worker needs is the manual training. Then, indeed, the laboratory work is educative. The student is put at his mowing machine and he has to take the machine all apart and put the whole thing together again and then run that mowing machine as it ought to be run; and when we have taught the laboratory work in that way we have the right kind of manual training, and the quicker we get over the fetish that has been held up to us for the last twenty-five years, that in order to educate a boy for a farmer you must put that boy to hoeing, chopping, or cleaning out the stable, the better it will be for the instruction of agriculture everywhere. That is is not the kind of labor we need especially to teach in the agricultural colleges.

Mr. Davenport. I would like to add a word to these remarks upon methods of laboratory teaching of agriculture. We must reduce somewhere, we must draw in; there are so many lines. I long ago gave up the idea of teaching the whole subject of agriculture to any one student. When we approach the technical work I hold that it is not necessary, in order to give discipline, that we put student A through all the labor system, through all the instruction in dairying, stock feeding, soils, and cropping. To build upon President Clute's illustration, if he takes apart and thoroughly studies a mowing machine is it necessary for him to take apart and study a reaper? No. A portion of it well driven in and nailed down is worth the whole thing smattered over.

Mr. Hays. I believe this morning is an opportune time to emphasize a matter that has been brought to my mind. I have never seen a lot of students—take the boy who has sort of got tired with study, the country boy who has failed to get a grasp on things in the country school—I have never seen a class of students who take as much interest as the boys who go into this kind of school where there is united some general text-book work with considerable manual training in our carpenter shops. These students not only get waked up, but during the few winters they stay with us they get a development that is remarkable. And these classes, when they graduate from this school of agriculture, with what training they have had, know something about raising corn, making roads, and raising chickens, even though they may not be able to electrify audiences with brilliant graduating speeches. It is the way this education takes hold of and develops the student which seems to confirm the wisdom of adopting this method of training. I should like to hear from Professor Smith upon this topic.

Mr. Smith. I am a crank; I am radical. In the first place, I believe that the only time to hold an agricultural course of instruction is in the summer. You may be ingenious enough, too, in substituting for actual farm work in some meager way the methods of house culture. We find in Michigan another thing; we believe in the old-fashioned idea, now so unpopular, that the best way to get a boy to working is to let him work. We strive as far as we can, Mr. Chairman, to make this work educational. We are second to none in this matter; where others give this instruction in words, we give it in deeds. We do not consider, however, that the work in farm mechanics is in itself an end any more than, as I said yesterday, the ability to use the forceps makes the botanist, or the ability to use the test tubes makes the chemist. The boy that will reap must plow; a boy that would harvest a crop must sow it. We teach soil physics—all of physics—and this relieves us of the necessity of teaching the purely elementary part. Let it be understood that the Michigan Agricultural College was one of the first to adopt the student-labor idea. Understand that we, as a faculty and as a board, thoroughly believe that the student-labor system as there practiced is the essential backbone of our agricultural college work.

Mr. Rane. I am but a recent graduate in agriculture, and it seems to me there is an opportunity for perfecting the departments of agricultural work in our various colleges. You will find that in many of the institutions we have agricultural courses that really run for three years, and in others four. Now, in Professor Hays's institution at Minneapolis, they have the full course of four years. After finishing the course there, many of his students go into the university; they go into an institution in which they are thrown in with men that have considerable brain capacity, and it is here that the agricultural college young men especially wish to come in contact with men. It is a sort of drawback to these departments to endeavor to carry such men in universities. I believe in institutions like the Minneapolis institution, which I visited in coming here, and I think that this is the practical solution of the problem. Now, men taking the three years' course necessarily have not got as much practical education as those who have taken four. The basis of agricultural education is the scientific work, and we must use that as a basis, and that is the reason at the present time that we have no system of books—we have no real arrangement by which students in agriculture are taught at the present time according to any standard. Everyone has his own ideas of teaching. Now, if we could make some arrangement by which we could have a standard of teaching agriculture, the present state of things would be reversed. We have, for instance, in the various courses of mathematics and sciences which we teach, a basis for an agricultural education; but they are not up to the standard that the purely scientific course is, and it seems to me that the graduate in agriculture should have fully as much work as the bachelor of science. Under the present arrangement men have passed the work and come out as college men with a degree that is not a degree on a two or three years' course.

The CHAIRMAN. The Chair calls up for consideration the next item upon the programme, "Some Elements of Permanency in Experiment Station Work," introducing, to present that subject, Director A. C. True, of the Office of Experiment Stations.

Mr. TRUE. Mr. President and gentlemen of the Association, before proceeding to a statement of some thoughts suggested by the topic formally given me, I wish, in an informal manner, to say something about the work of the Office of Experiment Stations during the last fiscal year. I deem it my duty, in coming annually to meetings of this Association, to present a summary of what the office has done in the interests of the great system of experiment stations in this country. As you well know, our work, to a very large extent, consists in collating and summarizing the publications of the experiment stations in this and other countries. During the year just past the office has issued twenty-four regular publications, not counting circulars and miscellaneous papers. The Experiment Station Record has been continued through another volume. Its form has been somewhat changed. It has reached, I might say, another stage in its development, in which all the matter presented is arranged in one series of topics, so that the work of foreign institutions is included with those of our own under one general series. The scope of this work has also been considerably enlarged, and we have therefore published in the Experiment Station Record considerably more matter in the same space than we did a year ago. In this work we have also had this year, more definitely than ever before, the cooperation of the scientific divisions of the Department of Agriculture and of the abstract committee of the Association of Official Chemists. Some idea of the work involved in the preparation of the Experiment Station Record may be given, perhaps, in a few statistical statements. Taking into account only the abstracts of articles in that publication, you will find that we have abstracted somewhat over 1,600 articles, which in their original form, in the different languages, contain just about 29,000 printed pages. These have been condensed into about 800 pages of the Record. In addition, we have given 2,100 titles of articles without abstracts. The number of publications of American stations abstracted is 295 bulletins and 42 annual reports. We have also included 70 publications of the Department. The editorials, special articles, and notes have made 200 additional pages and the index, 155 pages, making in all about 1,200 pages in the volume. The editions of the Record have been 8,000 copies. There is a constantly increasing demand for this publication, but at the same time the publication is growing increasingly technical, and it is probable that after the current volume is issued we shall restrict the circulation. A greater effort will, however, be made to supply the demand for information about the work of the stations in this country and abroad through our publications of a more popular character. In addition to the Experiment Station Record, the office has issued five bulletins, comprised of 824 pages, besides the Annual Report of the Director and an article for the Year Book Department for 1894. We have also done considerable work on three bulletins which we hope to issue next year. The work on the Index of Experiment Station Literature has steadily progressed. During the year about 3,000 cards have been printed at the Government Printing Office and distributed to the stations. In the Farmers' Bulletin series, the office has issued this year seven bulletins, comprising about 200 pages. Of these seven, three have been prepared by men engaged in work in the experiment stations or the colleges. Of the thirteen Farmers' Bulletins thus far completed in the office, six have been by men outside the office, directly connected, with possibly one exception, with the experiment stations of the country. The Farmers' Bulletin work of the Department has, as you know, greatly enlarged. Until the present year very limited funds were at the disposal of the Department for this purpose. Now that we have larger means, it is the intention to greatly develop this line of work. As one feature of the office work, it may be interesting to know that our correspondence, as compared with two years ago, has more than doubled. We received during the last fiscal year about 18,000 letters and sent out some 20,000. It is probable that during the year not far from a million copies of publications issued by the office, and representing very largely the work of the experiment stations, have been distributed throughout this and other countries. The library in charge of the office has been increased during the year by the addition of 720 books and pamphlets, besides a large number of periodicals. The exchanges from foreign stations have largely increased in number. Congress, as you know, laid a new duty upon the Secretary of Agriculture with reference to the expenditure of experiment station money; and the work on this line has been intrusted to the Office of Experiment Stations. The financial schedules were issued as soon as practicable after Congress passed the bill last autumn. It should be clearly understood that the enlarged powers of the Secretary of Agriculture in this direction have been confined to the fiscal year just past, and that any examination of accounts which he might make under the law would pertain to that year exclusively. This, perhaps, will suggest one reason why the work of visiting the stations was not entered upon earlier in the year. It was thought best to wait until the stations had matured their plans for the expenditure of the appropriation for this year.

It has seemed desirable, not only that we should have the publications of the stations to show what has been done and the financial schedules made out in the form prescribed by the Department, but also that we should learn more definitely regarding the work and expenditures by a personal visitation. The office has entered upon this work, and a considerable number of the stations have already been visited. These visits, I might add, are intended to be more than mere inspections regarding expenditures; they are rather in a larger sense to be conferences with station officers to learn the conditions and needs of their work, to get their views on many of the complex problems involved in the management of the station work, to ascertain how the funds intrusted to them have been expended, and also how the work of the stations may be made more effective and useful. It is believed that only by taking into account the local environments of the stations and the circumstances under which their work has developed that a just estimate can be formed of what they have accomplished, as well as of the proper limits of their work.

Another line of work which has been imposed upon the office during the year, under a special appropriation, has related to the investigation of the nutritive value and pecuniary economy of foods. This work has been under the immediate direction of Prof. W. O. Atwater, and studies have been carried on at Middletown, Conn., New York City, New Brunswick, N. J., Chicago, the University of Tennessee, in Alabama in connection with the Tuskegee Institute and the Alabama Experiment Station, at Charleston, S. C., Purdue University, the University of Missouri, and at Pittsburg, Pa. These studies have involved the consideration of food supply, the determination of the constituent elements of food by analysis, and inquiries regarding methods of work, the improvement of apparatus, and special studies. There has also been compilation of the results of European studies. Two bulletins on foods have been issued during the past year, and others are in preparation.

The office, I may say, in general, has endeavored as far as it was able to do what seemed to be useful to promote the general interests of the experiment station enterprise. It is our desire to understand, as fully as we may, the needs of the stations, what we can do to help them, and how we can improve our lines of work. We shall always welcome suggestions from station and college workers regarding the work of the office, and shall endeavor to do what we can to promote their interests in the Department.

Permanent Elements in Experiment Station Work.

Americans have hardly yet grasped the idea of permanency in institutions. For a time, the rapidly rising tide of population was held back by the Alleghanies, and it seemed as if society would assume definite shape in the New World as it had in the Old. Fortunate epoch—for it gave us independence from European control and a Constitution of marvelous strength and flexibility. But when once the barrier of the Eastern mountains was passed the surging crest of the tidal wave of emigration swept onward and outward with ever-accelerating rapidity, until the farthermost limits of the great West were reached, when the eddying currents ran hither and thither into the fertile valleys, and even up on the arid highlands. It has been a period of perpetual change and motion, and is not yet closed. Every now and then a President's proclamation removes the artificial dam built across some Indian reservation and the "boomers'" flood covers the land in an hour. Under such conditions, how is it possible for individuals or communities to settle down to a calm and steady life or to realize that what they build to-day will not be torn down to-morrow? To "hustle" seems to be the highest virtue, and it is well-nigh impossible to make men see that "haste makes waste." "Act in the living present" is the only motto that seems worth regarding. To plan for the great future requires room and opportunity for quiet thought and patient endeavor, but where can one find either when cities and States are being built in a day? There has been no past. And what, after all, is the future? Magnificent achievements, marvelous development! Yes; but let us try to get our breath in this rarefied atmosphere and consider whether the life of society has any other elements than enterprise and energy. Whether, in fact, the body politic should not have a solid skeleton, as well as swift-coursing blood and highly sensitive nerves. While naturally the most extreme examples of the unrest and shifting of American affairs are found on our most recent frontiers, yet the same spirit is manifested to a large degree even in our oldest communities. How few of our business houses last beyond a single generation. Most of the churches, even in our great cities, are located and constructed without reference to the requirements of the coming centuries. Our schools and colleges too often are living from "hand to mouth," with no apparent realization of the measures necessary to the growth and development of institutions which are to mold the thought and activity of the ages, apparently forgetful of the fact that it is as much the atmosphere of Oxford and Rugby, or even of our own Harvard and Yale, redolent with the wisdom of a long past, which gives form and vigor and the indefinable grace of a true culture to the youthful mind and heart as any prescribed course of training or even the influence of the living teacher. The American loves politics, and may even be said to have a special genius for government, but one might imagine from current newspaper talk that many among us believe that our nation's fate is trembling in the balance all the time and that total destruction may come with any passing strike or Supreme Court decision or Presidential election. We sometimes shout, "The Union forever!" but we go on building post-offices and custom-houses with such hideous architecture and flimsy construction that the stranger landing on our shores is led to inquire how soon the Federal Government expects to give way to the autonomy of the States. Even in Washington we have a great Pension building which is usually mistaken for a railroad depot, and a Department of Agriculture largely housed in wooden buildings made out of second-hand lumber. It is becoming fashionable to possess what are nowadays called "altruistic tendencies," but I fear that much of our current altruism is confined to efforts to make the world in which we now move more comfortable, to save ourselves the pain of beholding misery and distress ever present before our own eyes. Altruism which takes posterity into account has little place in our midst. We are perfectly willing that as many of us as possible shall enrich ourselves by cutting down the forests. It is none of our concern whether the men of the next century have material for houses or sufficient rainfall for agriculture. And yet there are some promises of a better day. I have lately been deeply impressed with the fact that the young and often thoughtless West has conceived one of those great ideas which permanently affect nations and bless all ages. In the development of great systems of irrigation the arid region has undertaken a task which argues well for the permanency, not only of her agriculture, but of her manifold institutions. These great reservoirs and waterways imply strength and endurance for the States which build them.

It may seem that I have indulged in a lofty preamble to the discussion of a humble theme. But I am convinced that the experiment station enterprise in this country has in it the potency of a vast influence on the greatest of our industries; that it is to be an important permanent feature of our system of institutions for education and research, and that its lines of operation run so close to the life and thought of millions of our fellow-citizens that its development will ever depend on the national appreciation of the proper equipment, operations, and atmosphere of those institutions which are established to promote the advance of civilization and to confer benefits accumulating in number and importance with the lapse of time. The experiment stations of to-day represent the best thought of our generation regarding agriculture, and their defects are largely the reflection of the current mistakes and ignorance of our times regarding the functions of institutions working in the interests of those departments of human life which have had a long past and are to have a long future.

When once we have consciously adopted the idea that the experiment station is to be a permanent institution having distinctive functions, our first effort, perhaps, will be to give it a form of organization which will make it stand out sharply as a distinct entity and at the same time permit it to develop gradually and steadily as its work grows in strength and importance. The station is very properly a department of the college or university, but for that reason it should not be split into as many separate pieces as it has different lines of work, so that we shall have an agricultural section of an experiment station, and a horticultural section, and a chemical section, but no solid experiment station. While it may be advisable under certain conditions that the professors of agriculture, horticulture, etc., shall be at the same time members of the station staff, they should not be allowed to regard their station work as simply an addendum to the other work of their college departments—to be shifted about as circumstances suggest. The station should be a department of the college as clearly defined as the medical school or the law school; it should have its definite programme of work, and its different lines of effort should be coordinated and systematized so that the public will feel that there is really a permanent agricultural experiment station—an organized effort of science to help the farmer. All this may be effected in such a way as not to interfere with the proper liberty of the individual investigator—indeed, his efforts may be stimulated to greater achievement with the aid of that esprit de corps which connection with an important and well-defined organization greatly promotes. Unity of purpose, aim, and organization will do much to secure the permanence of the experiment station.

Under our system, the control of experiment stations, as of colleges, is committed to boards of management variously constituted, but perhaps most often appointed by the governor of the State. The functions of these boards are, as a rule, loosely defined in the statutes creating them. In a general way, however, it may be said that their proper duties consist in determining the general policy of the station, appointing its chief officers, supervising its expenditures, and standing between the people and the station workers to prevent popular clamor and caprice from interfering with station work and to secure adequate results from the disbursement of public funds. These boards, properly constituted, are composed of eminent citizens who have manifested deep interest in agricultural education and research and who understand the needs and duties of the institutions they are called to supervise. In this country good men for such boards are usually very busy men. They have neither the time nor the training which fits them to make detailed plans of station work or to closely supervise the progress of the investigations. When they have carefully selected the proper agents to conduct experimental inquiries in agriculture, with the aid of such expert advice as they can secure, they must be content to wait until results may reasonably be expected before they attempt to sit in judgment on what has been done. It will be perceived that our ideal member of a board of control of an experiment station must be a wise and patient man, and that his functions are of such a delicate nature that experience in the management of such matters ought to make him increasingly valuable to the station and to the community. It is quite essential, therefore, to the permanence and efficiency of the experiment stations that their boards of control shall be stable bodies. The tenure of office should be such that violent and abrupt changes of station policy and work will be out of the question. Wherever political, personal, or other unworthy motives play any considerable part in the selection of members of boards which are to govern experiment stations, there is little hope that sufficient permanence in station work will be maintained to produce the best results. Our people have yet to learn that failure to secure good results from investigations in agriculture rests primarily with the governing boards. They are to be held responsible for the efficient management of these institutions. In their hands lies the destiny of the stations to a greater extent than we have perhaps imagined. It is of the highest importance, therefore, that a righteous tradition regarding the membership and permanence of these boards, shall be established in our different communities. That it shall come to be a matter of course that honest, intelligent, and experienced men shall be kept on these boards and that the lines of station policy once fixed in right directions shall not be turned aside for trivial or improper reasons.

The idea of permanence should be prominent in the minds of the governing boards when they select the officers of the station. Of course, there will inevitably be more or less shifting about in the subordinate positions, but the responsible officers of the stations must have long tenures if the station work is to be what it ought to be. All the formalities of introduction to office and of continuance therein should be such as to facilitate the choice of able men and to make their positions secure and comfortable. It needs only a superficial survey of our institutions for education and research to discover that in what everybody would consider the best ones there is extraordinary permanence of official tenure. Who expects that a president or professor of Johns Hopkins or Harvard University is to continue in office only for a year or two, or be subject to the cruelty of taking his chances of reelection annually or biennially?

Considerable pains are taken to get good men for these places, and then they are allowed to settle down to work in security and make the most of their opportunities. Of course many men of mediocre ability get into the faculties of even our greatest institutions, but on the whole that plan which secures the greatest permanency in the personnel of educational and scientific institutions gives the best attainable results. No doubt the American spirit of change often leads the individual workers to voluntarily go from place to place, on insufficient pretexts, to their ultimate disadvantage, as well as to the injury of the institutions they serve. A truly great or useful man is after all not altogether dependent on his surroundings. It may even be better for him to remain in a smaller institution. When the importance of permanent work at experiment stations is more firmly fixed in the minds of both governing boards and station workers, we shall expect to have far fewer changes than at present, to the mutual benefit of the station and the investigator.

Another permanent element of the experiment station is its records. Hitherto this has been much neglected. It rarely occurs that institutions become alive to the desirability of a complete record of their transactions until the time for making such a record is past. I have known several educational institutions which finally awoke in great surprise to find that they had nothing like a complete record of the students who had attended them, or even of their graduates—that anything like an adequate history of the institution was out of the question. The accumulation of data which may be of service in the interpretation of nature's laws is one of the important functions of an experiment station. Many facts and phenomena will be observed of no apparent value now which may have great significance after the workers of to-day have passed away. If we really believe we are not working simply for our own day but for all time, we shall carefully record what we do and see, and arrange as far as in us lies to have those records transmitted intact to those who come after us. Time and thought should be given to the form of station records, that they may be orderly, compact, and intelligible, and sufficient clerical assistance should be provided to make them reasonably complete. Of course, such records are the property of the institution and not of the individual, and the authorities should see to it that they are not removed from the custody of the station. There may easily be extravagance in the preparation of unnecessarily elaborate records, but on the other hand what seems to be a saving of a few hundred dollars for a clerk may result in an ultimate loss which can not be calculated in figures. Besides the records of individual experiments, there should be certain general records, such as those regarding the station farm, a history of the different fields and plats, the soil, the climate. Some stations in the West are beginning with almost virgin soils. What a grand opportunity to record the changes in the physical and chemical properties of soils due to various known influences. Soil science demands the accurate recording of facts for many years. In this way alone is there any hope of discovering principles or building up a true science of the soil. What is true here is equally true in other lines. I wish simply to emphasize the necessity of more attention to the planning and keeping of station records. I know some of the difficulties, but I believe they may be overcome. I know something of the good work in this line which is being done. I am now presenting the other side.

I suppose that we will all agree that the station records should be more than a series of notebooks. Specimens, photographs, and drawings should illustrate and complete the written records. These should be gathered and arranged on some consistent plan, so as to be far more than a heterogeneous mass of material. Proper provision should be made for the housing of these records. If they can not be kept in fireproof buildings, then at least safes should be provided in which to store them. They should be made and kept under such conditions as will secure them from alteration or destruction.

The printing of these detailed records should not be thought of. Indeed, much that is now put in station bulletins and reports might more wisely be left in the manuscript books in the station safe until enough data have accumulated to make some sort of a satisfactory conclusion possible. Instead of more leave to print, the stations need, perhaps, more compulsion to record and to wait.

As regards the printed matter issued by the stations, I am inclined to think that if the idea of permanency had been more prominent in the minds of the authors there would have been more care in the composition, editing, and typography, and even in the subject-matter. That concise Latin motto, *Scripta manent*—what is writ sticks—should be pinned up in a conspicuous place in the desk of every station writer.

Each station should have a few investigations which it proposes to carry on for a long term of years. In regard to these, what care should be taken in planning, what faithfulness in executing, what accuracy in recording. What a test of the real manhood and greatness of the investigator is presented here. He does not expect to see the end of his labors. What he sows another shall reap. Yet into this work he puts more of wisdom, earnestness, and painstaking than into all his other labors. It is a great and permanent work, therefore it must be done well. It is a cathedral of truth—deserving a great architect, wise master builders, cunning workmen. Each arch and pillar, every beam and architecture, every curve and decoration must be the best that can be made. However out of sight, each part must have its true finish. The reward of the workers is not in having their names blazoned on the portal, but in the thought that their work shall rejoice and bless the coming generations.

I have no fear that we shall fail to embody the permanent elements in experiment-station work in suitable form and dress when once we have become possessed of the idea that these are permanent institutions. The needs of the present hour have necessarily occupied most of the attention of our station workers. These needs are pressing still and must be met, but in some way we must find space and opportunity for permanent work. When the station enterprise seemed of doubtful usefulness and likely to continue only a brief time, there was perhaps some excuse for transient effort and irregular, fragmentary records. Now, when the usefulness of agricultural investigations is absolutely determined, when no voices are raised to abolish but all true friends of agriculture seek to uphold and strengthen the stations, it is hardly less than criminal to let the years slip by without making those arrangements and writing those records which will secure the most lasting benefits to the cause of agricultural advancement. Not in the sand of the desert but on some rock-hewn pyramid let us write what may now be only the hieroglyphics of truth. One day the interpreter will come, and we shall be found to have inscribed there a prophetic revelation full of comfort and blessing to our fellow-men.

On motion of Mr. Wheeler, of Rhode Island, Dr. True's paper was referred to the committee to which the president's address was referred.

The Chairman. The attention of the convention is called to a portion of the constitution which provides that "the annual convention of the Association shall comprise general sessions and meetings of the sections, and provision shall be made therefor in the programme. The section meetings may be simultaneous or otherwise, at the discretion of the executive committee, but at least two sections of the Association, to be designated each year by the executive committee, shall present in general session of each convention a portion of the subjects coming before them." Two such subjects are now to be presented from the Section on College Work. First, "What Studies Should be Embraced in the Four-year Bachelor of Science Course?" This question is to be opened by President Ellis.

Mr. ELLIS. I deem it exceedingly unfortunate for my subject and those who are interested in the discussion that the subject comes up at the noon hour; for it strikes me that after we have remained on these seats three hours it is rather an inopportune time to enter upon a long discussion of this topic. I have neither had time nor inclination to prepare a paper, consequently I have no excuse to present for not having prepared a production on this question. I feel that the topic is a very important one, and I shall ask your indulgence as I proceed to the discussion of it in such manner as I may be able. I am not responsible for the fact that I stand in your presence at an hour when, as it was said of Burke in the House of Commons, "he pursued his subject while his auditors were all dining," and whether my auditors shall be dining or not I am going right ahead just as though I were the first on the exercises of the day. I am to discuss what are the requirements for a four-year course leading to the degree of Bachelor of Science. I will let my mind run back to my own college days. Nearly thirty years ago this year I received that degree from the State University of Ohio, and I have been trying to think what were some of the branches over which I passed and from which I received that degree thirty years ago. That course embraced algebra, geometry—descriptive geometry—surveying, navigation, trigonometry, and integral calculus; that was the course in mathematics that entitled me to the degree of Bachelor of Science. In the course of English, I had, as near as I remember, as follows: Watts on the Mind, and I wish to say that if all of us had a little more of "Watts on the mind" it might be a good thing; then we had Liddell's History of Rome; we had something of Hume's History of England—it began at the fourth volume, in the reign of Queen Elizabeth, I think; Perry's Evidences of Christianity, Butler's Analogy, and something in the way of the history of civilization as found in the little condensed text-book of Guizot. We had something of physiology, something of physics, something of chemistry, something of geology and mineralogy, and something of biology and botany; and all we received in the way of science we received from one man, who was designated in the catalogue as "professor of natural sciences."

Now, that is the course which I had that entitled me, thirty years ago, to the degree of Bachelor of Science. But I wish to say to-day, without fear of intelligent contradiction, that there was far more of culture in connection with that course than there is in three-fourths of the courses to-day that we have in our agricultural colleges and technical schools. I verily believe that the hands of progress in respect to culture have turned backward. Of course, it is a fact that our instruction in science was of a very rudimentary character; yet I believe to-day that that course would not be a very bad course, with one or two amendments, to lead to the degree of Bachelor of Science. That course took us about four years. We had access to a library of 9,000 carefully chosen volumes; we had access to the regular college classes—sat side by side with them and pursued those studies under the same instructors. The advantages extended to the students of both classes were the same. Now, coming back a little more practically to the subject, I might remark that the number of studies to be included in the four years' course will depend very largely upon the requirements for admission to that course, for, as you can readily see, if the requirements for admission are of a very rudimentary character the subsequent courses must be limited; while, on the other hand, if we can require of students who seek admission to that four years' course leading to the degree of Bachelor of Science a more extended preparation, then the four years' course can be made more fruitful, both in the way of practical work and in the way of cultural work. I am pretty much in the position of the wise man of old; of this we may be sure: "Of the making of books there is no end, and much study is a weariness to the flesh." I think I saw, some two or three years ago, in type, a list of the degrees conferred by the various American colleges of high and low degree; and, if I am not mistaken, that list was so extensive that it would occupy the whole time allotted to me this morning in merely enumerating the degrees conferred in American colleges. As to the meaning of the degree of Bachelor of Science, one puts one interpretation upon it and another another interpretation, and the practice of the different institutions by which this degree is reached is as various as the number of institutions themselves.

It is customary in some of our agricultural colleges, the institution that I have the honor to represent, for instance, to confer the degree of Bachelor of Science upon all graduates of the institution, although we have four clearly differentiated courses of instruction. Now, is not the culture of each of these four courses of study equal to the culture of each of the others? And yet the only degree conferred by the institution is the degree of Bachelor of Science. Now let me ask your attention for a moment to some of the requirements for admission to these courses. In some institutions, for instance the Michigan Agricultural College, the institution at Manhattan, and others, these requirements are made rudimentary, not by action of the faculties of the institutions themselves, but by action of the legislatures. It is a legislative enactment that they shall receive pupils who have passed with fair credit through the courses of the common schools and have reached the age of 15 years. Now, that is the qualification on which we must admit students to our preparatory classes. We have some students who, under a strict interpretation of the law, would be entitled to freshmen standing, and by making the course five years instead of four we are enabled to round up a fairly good course of instruction, and when we confer the degree of Bachelor of Science we should endeavor not to confer it altogether without the person upon whom it is conferred being entitled to it. Other colleges require a much more extended preparation in the lower courses leading to the four-year course for the degree of Bachelor of Science, in the way of American and English literature and in the way of the study of the English language. It will take, possibly, algebra through quadratic equations. It would require of students in the same cases a little preparation in the way of Latin and German. I believe that these are about the highest requirements by the institutions of which I have knowledge at this time for the course leading to the degree of Bachelor of Science. There is some slight difference between the requirements for admission to these different classes of schools.

It will take a student some time to acquire a knowledge of English and American literature, for instance. We know what it is to conduct a class in algebra so that the members will be familiar with all the operations of algebra up to quadratics, and to take them through a course in what we might call about six books of plain geometry; that the time required for the mastery of these subjects, at least, would possibly be equivalent to one and one-half or two years of ordinary instruction. Now, there is a gap that we will have to bridge in some way; there is a gap that we will have to eliminate in some way. Now, what I have to say upon this course of study (in the preparation of this course, we have followed the ideal course, not my own), we give the degree of Bachelor of Science to four different courses built upon the attainments of the student in the public school course. Of course I am not here to say that this is the rounded course that should be required for the degree of Bachelor of Science, and, as has well been suggested, our environment, our circumstances, seemed to make it necessary at this time that we should hold our course to about the subjects that are now included in it. My ideal course leading to the degree of Bachelor of Science would be a thorough acquaintance with all those branches which we know and designate as "common-school branches," in addition some culture derived from the study of English and American literature, the study of some elementary text-book on civil government. I should require of the student a thorough knowledge of algebra as far as quadratics, and he should have all the culture that would naturally follow in the wake of such instruction as would lead to that work.

Now, having that as a preliminary basis or as the qualification for admission, I should build upon that a four-year course, and that course should take into consideration the clearly recognized nature of the human mind. I believe that if we need to enter any protest, it is against overzealousness in prosecuting specialties. I am of the opinion that we want to have a man well rounded before he begins a course of study leading to some special degree. I do not believe in allowing a young man just entering upon a college course to choose some special course of his own when he shows by every appearance that he has not the faintest conception of what a college course means. He desires to pursue a course in chemistry. You will ask the young man what he knows about chemistry; he answers that he does not know very much about it, but he has heard the word "chemistry;" he thinks that it is a pretty nice thing and he wants to study chemistry; it may be that he can not spell; he can not write an English sentence correctly; he does not know anything at all about the fundamentals of an English education. When we have a young man of this character apply for admission we try to beat some sense into his head; try to get him to consent to go right down and sit at the foot of the college course before he attempts to go to the top of it.

Another student, a young lady, will come into the college, and she says: "I want to become a stenographer; you teach stenography, and I want to pursue the study of stenography." We ask her: "What do you know about English grammar? Are you a good speller?" She answers, "Oh! I haven't thought much about that; I want to study stenography!" And every question you ask is answered by the plea, "I want to study stenography." We say to her: "Do you not know that the stenographer must know how to spell? That a stenographer must have some idea of the construction of an English sentence? That a stenographer ought to be a well-read person? That he could not possibly take down the address of anyone in which there is involved the expressions and allusions employed by those who have acquired an English education unless he also has a fairly good education and is able to know what a quotation is and to put it down in an intelligible form." She says you are entirely too practical for her, and she leaves, much to her own disgust and much to your satisfaction. Now, this is what I want to protest against. I would not allow any student to enter upon such work as that under any circumstances whatever unless he had the foundation of a good, common-school education. This new institution, it has a tendency, I say, to let down the bars and to allow admission under that kind of work too easily. Now, as I said before, I have an idea that an education can be too much in the line of specialties. There are certain studies that are absolutely needed to round it out properly. There is so much of history that every scholar ought to have; there is so much of civil government that every scholar ought to have, and so much of literature and general culture of the imagination and uplift of soul that comes from the theoretical and intimate acquaintance with these studies that we can not dispense with them in any well-rounded system of education; and I have been—and you will be—surprised in this convention to hear, on more than one occasion, the members addressing the convention speaking about "equivalents." My friends, there is no equivalent for any of that kind of work. You can not study agriculture as a science ten years and take it as an equivalent for that general education that every citizen ought to have.

I do not believe, my friends, that it was the intention of the law to which these institutions owe their existence that the instruction to be given in them should be along little, narrow, special lines. I only wish, from my knowledge of matters as an educator, that it were possible for us to defer all kinds of specialties until the student had accomplished an all-round course leading to the degree of Bachelor of Science; but this idea of taking a boy or girl who has just the rudiments of an education as taught in a country district school and turning him out as a specialist in mechanics, agriculture, horticulture, chemistry, and other lines in science, I believe is detrimental to sound learning, and I believe there is nothing to-day that is driving the agricultural colleges of this country into such just disrepute and just contempt as the idea of them which many people have that a mere smattering of education will do. I would have this course, then, begin upon the kind of cultivation that I have attempted so imperfectly to present in your presence. I should have it embrace all the scientific work that we now have; I should have it include history and literature, and I should by all means have it include at least two years of German and French. Now, I believe that when the student has accomplished that course under proper instruction, under instructors of wide experience, that that student will go out entitled to the degree of Bachelor of Science and with the amount of advancement and accomplishment that will bring honor and credit upon the degree and the institution that confers it. It seems to me we ought not to make this degree too cheap. Give your degree of Electrical Engineer and Mechanical Engineer, but in the Bachelor of Science degree, as I see it, it means more than that special work; it means an all-round, well-guarded scientific course, in which the humanities are not excluded, and that is the kind of a course I would have in the course which is intended for the degree of Bachelor of Science. Now, my friends, I do not believe that the use of such a course would in any wise detract from the importance and value of the work that we may now be doing in the way of special scientific agriculture or in training in the mechanic arts. I believe that with such a course of study as that assigned as the central course in your institutions, that the student will have greater incentive for the highest attainment of intellectual work. I am heartily in sympathy with the idea that we want to have a great deal more of the cultural in our college work. I wish to say here that I am giving away no secret when I say that every one of us knows that the colleges of liberal arts offer more systematized work in the way of building up the cultural in the minds of the youth of the land, and most of you know how difficult it is for us to come into competition with them, and our short courses and short cuts, and our degrees of "Bachelor of Agriculture" and "Bachelor of Scientific Agriculture" afford them grounds for criticism and comparisons unfavorable to our institutions, and we ought to be willing to make a long step in advance, I tell you, if these agricultural colleges are ever again to ground themselves in the confidence of the people of the country. They are going to do more work than they have ever done before. I verily believe the more of mind culture, the more of soul culture, you can put into the mind of a young man, the more you have done to build up work along specific lines.

Mr. ANDERSON. After the eloquent discussion that we have just listened to, it is almost needless for a young man to attempt to add anything. I have listened to the discussion of President Ellis, and I agree with him in almost every particular. It seems to me that this is the right method, and I believe that every man in the convention agrees with President Ellis. We need more culture; we need more science. How are we going to strike a happy medium? So far as the multiplication of degrees is concerned, I think the American colleges are making a mistake. I believe we should have in our American colleges scientific courses that perhaps are identical up to the junior or sophomore year, and after that time specialize. I think we might arrange a course to be known as the mathematical course; we might arrange another course and call it the biological course, each leading to the degree founded upon that course; a chemical course leading to the same degree. It is a very difficult problem to determine what studies ought not to be comprised in these courses. I question whether the scientific courses as at present organized are able to carry on the cultural. It seems unfortunate that our scientific courses are so organized now that we are compelled to gradually cut out the humanities. I hope that the movement in that direction will stop. We do not get enough of culture studies, but with the immense development of scientific lines, how are we going to crowd into the four-year course all the culture studies and scientific studies we need? A great deal has been said about developing ideal courses of study, and the attempt has been made and more papers written to develop a course of study in mechanical engineering, for instance, and that will apply to all the colleges of the country. Now this is a useless waste of energy. The conditions for admission and the amount of money at the disposal of the college and various other things have to be taken into consideration. I am not versed in scientific courses, and I have no authority to speak upon them, and perhaps what I say is of no value whatever, but the same thing would apply to scientific courses that applies to the mechanical engineering course. A college can not hope for the State to do better for them in agriculture, perhaps, than has been done for the State College of Kentucky. I will outline briefly what I would consider an ideal course in science. A course of mathematics running, perhaps, through analytical geometry, with an additional five months of calculus; two years of English literature, five months of physiology, five months of chemistry, five months of biology, five months of botany, five months of metaphysics and logic, two years of English, and perhaps one year of German, and one year of French. I would give at least one year to history if such a general course of study could be arranged for a Bachelor of Science degree. We want to specialize. I think it is the tendency to specialize. I believe in specializing to a certain degree, although I have great confidence in what President Ellis has said, and agree with him thoroughly. We are tending toward specialists in science. If a man wants to devote himself to chemistry, you have enough time left to fill up the course with chemical studies. If he wishes to devote himself to mathematics, put more mathematics in the course. There you would have three separate lines to eliminate the culture studies, and if any other line of work is necessary to be developed, the course could be so extended along special lines. As far as the special courses are concerned, I believe we ought to have a degree in agriculture. I am in sympathy with the Bachelor of Agriculture degree. The thing for the agricultural men to do is to dignify that degree. I believe we ought to have degrees for the mechanical course. There is a tendency, I will admit, to multiply the number of degrees, but I believe that this is one of the things that will be a necessity. In general, then, for all technical courses of study give special degrees, but for all science, as I have outlined in these three courses, give the Bachelor of Science degree.

The CHAIRMAN. The next speaker upon the topic under discussion is Professor Hilgard.

Mr. HILGARD. Mr. President and Gentlemen of the Convention: I can first say that I agree most thoroughly with everything that has been said by President Ellis. There is one point of view, I think, which has been somewhat neglected or overlooked by the previous speakers, and that is this: What are we aiming at in the education of the students at our colleges? The Morrill Act says that these colleges are designed to teach science, meaning the agricultural and mechanical arts. If the idea is that we are to educate the rank and file of the farmers' boys to be farmers it is one thing, but I think that is simply impossible, and so long as the colleges try to do that I think they will simply fail to accomplish anything that is really worth doing. I have put myself on record in regard to that matter so often that I am afraid I shall tire others by repeating that I do not think that these colleges were intended to educate the rank and file; that in educating the leaders they do the best possible service, and that this was the purpose which was intended to be subserved by Senator Morrill himself. Now, while I say "leaders," I mean that it will be better for these colleges to educate a few thoroughly, who will be shining examples to their fellow-farmers, than to educate a number poorly and have them go out as a reproach to the system of these institutions which was forced upon them and which has to be taken as a guide. Now, then, if we are to educate the leaders, what kind of leaders do we need? I think there are two chief classes (I mean those apart now from the farmers themselves); there are two classes, I think, that need to be educated, and those are the officers of the colleges and experiment stations—of which there are far too few—and then we want to educate a very large number of men who will be able to teach the agricultural sciences in the schools, which I consider, of necessity, will have to be a link between the college and the common school. I am not prepared to say that the common school will not ultimately take part in the education of the farmer; but it is quite certain in my mind that from what we have heard from Mr. Hays in regard to the high-school course which they have adopted there that that institution is a fine example of what ought to be done in other parts of the country. In fact, I rejoice to hear from Professor Hays of the condition of things in that institution; it is ideal, in my mind. We have there the agricultural student, who is to be an all-round man, and can hold up his head everywhere alongside of the student from other universities, and that, if the agricultural student has relegated the farmer to the ranks, is simply putting the farmer just where the farmer ought not to be, namely, relegated to the ranks. Let us educate the men who are to represent us effectually; and here I wish to put in something which struck me during the discussion in this room.

We are a republic, which rests upon the farmer as a population. The largest portion of our industries are based upon farming, and yet it is a remarkable fact that the farmer is looked down upon in this country; he is called a "hayseed," he is called a "granger," and everything else; and while the politician seeks his vote, he gives him the cold shoulder as soon as he gets where he does not need his support. But I ask the farmers, "Whom do you send to your legislatures; whom do you send to Congress by your own votes? Are they the men who are in sympathy with you? Send your sons to the agricultural college, so that they can hold their own alongside of any lawyer or any doctor or other professional man." So far from segregating from the university the means for obtaining the highest education in the State, I would put in another attic with a good dormitory and kitchen for the accommodation of the farmers' boys; I would have the agricultural college furnish the highest education in the State. It is one of those mistakes which the farmer makes; it is still contended—and he simply gives himself a black eye by contending—that the farmer is not worthy, as it were, to be associated with the higher education of the State. Then will the farmer get his rights if that is done. And why? Because he has got as much general culture as has any other class. We will invariably do precisely what we wish to do. I think I made it understood last evening that I believe in short courses, but I believe in them only as such, and I do not believe in giving any degrees in short courses.

I believe the degree of Bachelor of Agriculture is an unnecessary degree; but I do mean this: That in every institution that has an agricultural course there should be a great deal of leniency and liberty in the admission of those who wish to study this subject, as far as educational qualifications are concerned. I will give you an example. In the University of California we have at this time as regular prescribed four-year-course students, I do not suppose over a dozen. Now, these do not go into the record as agricultural students, but they have attended the lectures and the college of agriculture is giving the benefits of its instruction to those students. Now, a large number of these could not have passed the required examination, and had we refused to admit them to instruction in the college of agriculture on that ground, when they went away, perhaps, finding that they had not accomplished what they hoped, they would probably have gone with this conviction: "If we had only known in time what was necessary to become good farmers we would have begun at the bottom." Now, a good deal of discussion has been had in the faculty meetings as to conferring the degree of Bachelor of Agriculture. Agriculture is not a single science; it is so many that it takes the broadest kind of a mind to overlook it all, and there is where the difficulty arises in the short courses. They must be men far broader than a great many of those who now occupy those positions. We have chemists, botanists, and physicists, and the biological and botanical laboratories with their specialists, but the all-round men are more needed in agricultural courses than in any other. I am delighted to know that there is one institution in the United States that can say that they have a course in agriculture which is accessible to the high-school graduates, such as are the courses in Europe, and at the same time be regular students in agriculture up to the full quality of the students in the scientific and classical courses. If we can not educate these men let us keep the courses high and not low. Is not it possible to prepare a four-year course in such manner that the young man or woman attempting to take it shall get the best possible results? I have arranged for the large number of special students that come to us a two-year special course; and this two-year special course produces very good results. I have found that those who are fairly well prepared in the public schools make very satisfactory progress in our special two-year course, but of course it is only a partial preparation, and is not what it should be.

A MEMBER. I should like to ask if that two years' course is of the first two years or of the second two years' course?

MR. HILGARD. It is of the second two years' course.

The CHAIRMAN. Shall the discussion of this topic be pursued further?

Mr. JOHNSON. Under items 3 and 4 of the constitution, relating to membership of the convention, provision is made for extending the privileges of the convention, except the right to vote, to visiting friends. We have with us this morning an interested listener and friend of the Association, the Hon. David Boyd, of Colorado.

The CHAIRMAN. By vote of the convention yesterday, Senator Boyd has the privileges of the floor.

Senator BOYD. I do not wish to say anything in particular on this subject. I am a graduate of the Michigan University. I understand a large proportion of the graduates of the Agricultural College of Michigan are engaged in professional work. Since graduating in 1866 in the University of Michigan I have engaged in farming, and have succeeded in making a living. I have found my practical experience in the art of agriculture by getting it in the field. Indeed, instead of getting training in the field at the agricultural college, I was getting field training in the summer on my father's farm. Now, on the whole, I admired very much the discussion opened by President Ellis. If we begin with a Bachelor of Science degree, I know that our agricultural college course is very unevenly adjusted for that degree, as President Ellis has told you. It is not the fault of the board of trustees; it is not the fault of the faculty. It is the fault of the State legislature in forcing upon students from the common schools a curriculum deficient in the culture studies, and it is utterly impossible to turn out men and women of broad and liberal culture in the four years' course as now arranged. In fact, you can easily see that they have just the intellectual training that graduates of high schools are receiving—that is to say, they are not as well prepared as those who go through the graded course of the common school to the high school—who have the advantage of the former by the addition of the general information which they get, and the result is that agricultural college students are exceedingly defective in the mental discipline derived from the culture studies. If they attempt expression in any way you will find it in their expression. If they attempt address in any way you will find it in their addresses. I think this must be the result with those students who have only four years in the agricultural college, and is the best result which they can give as long as they have the present studies in the curriculum.

The CHAIRMAN. It is moved and seconded that the general session do now adjourn. Carried.

EVENING SESSION, WEDNESDAY, JULY 17, 1895.

The session convened at 7.30 p. m., Vice-President A. A. Johnson presiding.

The CHAIRMAN. The first thing is reports on resolutions.

Mr. MURKLAND. The committee on entrance requirements, appointed at the last annual meeting of the Association, having organized by electing Charles S. Murkland chairman and Dr. A. W. Harris secretary, proceeded to carry out the instructions of this Association. Those instructions were, to confer with the New England Association of Colleges, the "committee of ten" of the National Educational Association, the Society for Promoting Engineering Education, and such other bodies and associations as might be; and to embody the result of such conferences in a report to this Association. Attempting, in accordance with these instructions, to find what were the common courses of study in our colleges, and to come at some means of equalizing these courses, we were preparing a series of questions to be submitted to the proper authorities in each college belonging to this Association, when we received a similar series of questions submitted by the Society for Promoting Engineering Education. That society held its meeting three or four months before ours, and I suppose that early in the coming year the conclusions derived from those questions and their answers will be available for consideration by this committee.

A little later, the Commissioner of Education, acting in behalf of the Department of the Interior, also forwarded a similar list of questions, and it seemed to this committee advisable not to incur any unnecessary expense by going over the ground thus already covered, or by acting before the reports from the Society for Promoting Engineering Education and from the Commissioner of Education were at hand. Therefore your committee suspended operations, waiting until such time as might make it advisable to proceed with its work.

It is probable that the report from the Society for Promoting Engineering Education upon this matter, which is absorbing so much of the attention of that society this year, will be received in time for some concerted action on the part of our colleges next year. If so, it will, perhaps, give us some basis upon which we may formulate a tentative system of entrance requirements for our colleges. And this is the important matter which was contemplated when this committee was appointed.

We have, therefore, to report simply progress. It is recommended that this work be carried on during the coming year, either by continuing this committee or by appointing a new one, so that at the next meeting of this Association some definite report may be presented. And with this recommendation, your committee respectfully submits its report.

Mr. STUBBS. I move that the report of progress of the committee on entrance requirements be received, and that the committee be continued, with instructions to report at the next annual convention upon the following points:

(1) A plan for uniform entrance requirements to the first year of agricultural and mechanical colleges.

(2) The extent and variety of the courses of study which may properly be offered by such colleges.

(3) The academic degrees which may be conferred upon students who have completed one of the several collegiate courses offered.

Carried.

Mr. JESSE. Since our Washington meeting last November, this Association has suffered the loss of one of its oldest and most valued members, Dr. Edward D. Porter, of Missouri. I move that a committee of three be appointed to draw up resolutions in memory of him, and as he was identified long and honorably with agricultural education in Delaware, Minnesota, and Missouri, I would suggest that the Chair appoint a committee from those three States. I request, however, that the representative of Missouri be not myself, but his friend, Dr. Paul Schweitzer.

Adopted.

The CHAIRMAN. The Chair appoints as this committee Messrs. Schweitzer, Raub, and Hays.

Mr. MYERS. It is time, I think, that the convention should be considering its officers for the next term, and I therefore move that a committee of seven be appointed as a committee on nomination of officers for the next year.

Adopted.

Mr. GOODELL. I have here a letter which I have received from the bibliographer of the Association, Dr. Johnson, which he desired me to lay before the convention, and in which he presents his resignation as bibliographer.

The CHAIRMAN. There being no objection, this letter will be referred to the committee on nominations after their appointment.

Mr. Armsby offered the following amendment to the constitution:

Amend section 2 of the articles of membership by adding at the end of the section the following:

"No delegate shall vote in more than one section, and each delegate shall, when presenting his credentials, designate the section in which he desires to vote."

The CHAIRMAN. This proposed amendment is in the nature of a notice, and under the terms of the constitution lies over for one year before it can be incorporated.

Are there any reports from committees appointed at this convention?

Mr. REDDING. The committee to which was referred that portion of the report of the executive committee in regard to its efforts to secure adequate compensation to those postmasters who handle large amounts of the franked mail matter of experiment stations, beg leave to submit the following resolution:

Resolved, That the executive committee be hereby requested and instructed to continue efforts on this line.

R. J. REDDING,
A. C. TRUE,
J. A. MYERS,
Committee.

Adopted.

Mr. MCCREA. I would like to ask if it would not be possible, very soon after the adjournment of this convention, for the executive committee to issue a brief circular stating the officers of the sections? I have thought that would be a very quick and easy method of bringing that matter to the attention of the colleges after we get home.

Mr. GOODELL. I will say, on behalf of the executive committee, that it would have been done this year, but for the fact that the notes of the convention could not be obtained in time.

The CHAIRMAN. It is understood that the suggestion will be followed without further action.

Mr. SCOVELL. The auditing committee begs leave to submit the following:

Your committee, appointed to audit the treasurer's accounts, begs leave to report that it has examined the same and finds them correct, with vouchers for each item of expenditure properly approved.

Respectfully submitted.

M. A. SCOVELL,
A. L. EMIGH,
S. P. MCCREA,
Committee.

The CHAIRMAN. It is moved and seconded that the report of the auditing committee be adopted.

Adopted.

The CHAIRMAN. The next business in order will be reports on the legislative action taken by different States for the control of tuberculosis.

Mr. GOODELL. Mr. President, I move that the roll of the States be called by the secretary, and that each accredited delegate be allowed to report what legislative action has been taken in his State.

Mr. JOHNSON. I would further amend that motion by adding that there be no discussion on this subject.

Motion seconded as amended.

The CHAIRMAN. It is adopted, and the subject is open for presentation under these conditions.

The secretary then proceeded with the roll call of States as follows:

Arizona? Mr. Comstock. I have to report that the legislation has been very slight during the last year. I think it was stated at the convention at Washington last fall that nothing had been done. I learned on my return that there had been some legislation. I also found that there was a slight amount of tuberculosis in the Territory. We have no veterinarian. The United States has done some work along the border in Mexico.

Colorado? Mr. Carpenter. We have had no special legislation in regard to tuberculosis. There is an appropriation made by the legislature for the culture and investigation of this disease, limited to $1,000 a year, and our State veterinarian has the power to suppress and quarantine. During the last three years we have only had three cases to report. We have not investigated all the dairies, but of all the cases reported, over twenty suspected cases, we have had but three definite and distinct cases. Our law gives the veterinarian and sanitary board authority to quarantine.

Connecticut? The legislature of Connecticut has at length provided a suitable law for the suppression of bovine tuberculosis in the State. It is not to any great extent a new law, but rather the very efficient old one rendered more complete and efficient by alterations and amendments. Briefly stated, the law as it now stands provides for the inspection of cattle, the quarantine of suspected cows or herds, and their products, the testing for tuberculosis with tuberculin, only with the written consent of the owners, the slaughter of condemned animals, the cleansing and ventilation of stables and premises where stock is confined, empowering the cattle commissioners to do all this and to make and enforce all needful regulations to secure and maintain a healthful condition of the dairy animals of the State. No specific appropriation is made to meet the expenses of the execution of the law, but it is left with the governor of the State to approve whatever expenses may be incurred by the commissioners. Practically, therefore, in lieu of a few thousand dollars, or any specific sum, the entire State treasury is at the command of the commissioners, but subject to the discretion and approval of the governor.

Iowa? Mr. Curtiss. No legislation, I believe, except that power is lodged with the State board of health to quarantine against it. If this refers to any legislation that may have been had heretofore, I would say that this is controlled under the general law for the appointment of a stock commission; but no special commission and no special legislation with reference to tuberculosis any more than that which covers all contagious diseases of stock, which is under the control of the live stock commission and the State veterinarian, and answers all the requirements upon that subject.

Kentucky? The quarantine regulation; not made this year, but made heretofore.

Louisiana? We have never tested for it, and since the dairy interest in this State is so small, we have thought it not necessary to stir the matter in Louisiana.

Massachusetts? Mr. Goodell. In Massachusetts there is, first of all, a cattle commission, consisting of five persons, having jurisdiction over the entire State. By law, in each village, in each town, in each city, the selectmen or other authorities of the place are required to appoint one or more persons who shall be inspectors of animals under such regulations as may be laid down by the cattle commission. This year, in addition to that, specific legislation has been taken which provides that: "When the board of cattle commissioners or any of its members, by an examination of a case of contagious disease among domestic animals, becomes satisfied that the public good requires it, such board or commissioner shall cause such animal or animals affected therewith to be securely isolated, or shall cause it or them to be killed without appraisal or payment. Such order of killing shall be in writing, and may be directed to the board of health, inspector, or other person, and shall contain such direction as to the examination and disposal of the carcass and the cleansing and disinfecting of the premises where such animal was condemned as such board or commissioner shall deem expedient. A reasonable sum may be paid out of the treasury of the Commonwealth for the expense of such killing and burial. If it shall subsequently appear, upon post-mortem examination or otherwise, that such animal was free from the disease for which it was condemned, a reasonable sum therefor shall be paid to the owner thereof by the Commonwealth: *Provided, however,* That whenever any cattle condemned as afflicted with the disease of tuberculosis are killed under the provisions of this section the full value thereof at the time of condemnation, not exceeding the sum of sixty dollars for any one animal, shall be paid to the owner thereof out of the treasury of the Commonwealth if such animal has been owned within the State six months continuously prior to its being killed, provided such person shall not have, prior thereto, in the judgment of the cattle commissioners, by willful act or neglect, contributed to the spread of tuberculosis; but such decision on the part of the commissioners shall not deprive the owner of the right of arbitration as hereinafter provided." "Until June first, eighteen hundred and ninety-six, the use of tuberculin as a diagnostic agent for the detection of the disease known as tuberculosis in domestic animals shall be restricted to cattle brought into the Commonwealth from any point without its limits, and to all cattle held in quarantine at Brighton, Watertown, and Somerville: *Provided, however,* That tuberculin may be used as such diagnostic agent on any animal or animals in any other portion of the State upon the consent in writing of the owner or person in possession thereof, and upon any animals condemned as tuberculous upon physical examination by a competent veterinarian."

Michigan? Mr. Smith. No specific legislation this year. The matter rests in the hands of a stock sanitary commission who have power both of quarantine and sale or use of tuberculin.

Minnesota? Mr. Hays. We have no special law. We have a State board of health who deal with these matters in a general way. In the station we have been experimenting on some cattle that were suspected of being affected with tuberculosis; we condemned about 25 head out of 75. The director estimated that there were 8, 9, or 10 head that really responded to the test, and he has been treating them with tuberculin during the year. Whenever one has quit responding it has been killed. Whether we will be able to do it in a larger way or not I do not know yet; it takes considerable money. He has tested a good many horses and found tuberculosis; in some of them a good deal of it; in others none at all. One herd of shorthorn cattle had a number of infected animals, and a number of these have been offered to the station to work with. Of course, that gift may be on the other side. I do not know just what provisions our State board of health have made for taking hold of the matter.

Missouri? Mr. Jesse. Missouri has a State veterinary service, the object of which is the suppression of all epidemic and contagious diseases. By act of the legislature the State veterinarian can slaughter animals suspected of disease, and with the aid of the governor the State can proclaim a quarantine. Any citizen of the State can call for inspection of animals at any time. There has been no special legislation on this subject of tuberculosis.

New Hampshire? Mr. Murkland. The bill passed both houses of the legislature appropriating $100,000 for two years to establish a commission for the purpose of stamping out this disease; but in the concluding days of the session this bill was vetoed by the governor, so that the matter stands now as it did a year ago, there being a cattle commission having full power to investigate and to destroy animals and being authorized to pay one-half the value computed for the animal in a healthy state, and to expend not more than $20,000 in one year. That seems to comprise the state of affairs as they are in the legislation of our State. In our station herd we had two examinations during the year, and found out of about 60 cattle 9 diseased. The second examination disclosed that those passed by the first examination were undoubtedly affected. Every animal killed as a consequence of the reaction of the tuberculin test was found to be infected with the disease. We have not found any evidence that the milk from cattle undoubtedly diseased is necessarily dangerous to man.

New Jersey? Mr. Voorhees. The law passed last winter simply allows the commission to employ a secretary, the necessity for whose employment is to be determined by a committee consisting of the governor, comptroller, and president of the State board of agriculture, who is, by virtue of that office, chairman of the tuberculosis commission. The law in other respects is the same as reported last year. Much good work has been done during the past year and is now being continued.

New Mexico? Mr. McCrea. The recent session of the legislative assembly empowered the cattle sanitary commission of New Mexico to quarantine against tuberculosis. I think the information came to me shortly before coming to this meeting that some animals had been destroyed in the northern part of the Territory on account of being affected with tuberculosis. I am not positive that this is a fact; I think I have such information.

I would like to add something further that I have since learned from New Mexico, if I may be permitted to do so. The matter had come to my attention about the killing of some cattle in the northern part of the Territory. We have no veterinarian in our Territory, either for the Territory or for our station, and this case was attended to by the State veterinarian of Colorado.

New York? Mr. Atkinson. I understood when leaving Ithaca that Professor Roberts would forward a report to the executive committee. There is a law upon the subject.

North Carolina? Not represented here.

North Dakota? Mr. Bolley. North Dakota has a veterinary board, consisting of three district veterinarians and the State veterinarian. They have, as I understand, a general supervision, with power of quarantine, of what they consider contagious diseases, and do not need to have any special power or instruction to authorize them to act in cases of tuberculosis. We have had some cases of tuberculosis among the horses in the Northwestern States, but the horses in other States have shown a much higher percentage of cases than among those of our own State. The farmers in North Dakota seem very much alive to the work, and allow their animals to be killed in order to check the spread of this disease.

Oregon? Mr. French. There is a very effective law in the State of Oregon controlling the disease of tuberculosis and other contagious diseases. The State veterinarian is empowered to destroy all infected animals, and I believe the law provides that the person losing such animals will be recompensed to the amount of the value per head and perhaps the cost of killing the animals. The city of Portland alone has paid out within a few years past for infected animals slaughtered about $50,000. Since that time there has been an outbreak among Shorthorns; during the past year there have been two or three outbreaks in isolated parts of the State, but not extensive. The State veterinarian is using the tuberculin test, and he says that in every case where he has had a reaction he has slaughtered the animal infected.

Pennsylvania? Mr. Armsby. There has been no legislation in Pennsylvania directly aimed at tuberculosis. All existing laws have been somewhat modified to enable the authorities to deal with contagious diseases. The chief addition, however, has been made in the matter of organization. The last legislature provided for the organization of a department of agriculture, under a secretary of agriculture, who has an office in this State; a live-stock sanitary board was established, composed of the secretary of state, the secretary of agriculture, and the State veterinarian. This board has full power to inspect and quarantine animals and to kill when they find any infected animals. The board has practically an unlimited appropriation for this purpose, the bills for animals killed being paid after the approval of the governor and secretary of agriculture.

Rhode Island? Mr. Flagg. Previous to 1892 the provision of the law relating to contagious diseases vested the control of this matter in the State board of health, but since then it has been turned over to the State board of agriculture, with an appropriation of $15,000. Here is a brief review of the work:

The board has power to appoint a veterinarian, and its work is carried out by appointing a cattle commissioner in each county and an appraiser at large. For cattle that are killed, if found diseased, one-half the appraised value is paid; if the animal is found healthy, the full value is paid, and a limit of $50 is placed upon any ordinary or grade animal and $100 upon any pure bred animal; and the animal must have been owned at least six months in the State before the owner can get any appraisement. In 1892 there were 237 animals killed; in 1893, 261; in 1894, 401; and up to May 1, 1895, there were 193 killed, making a total of 1,092 animals killed from

June, 1892, up to the 1st of May, 1895; and in June, 1895, 37 were killed. Of these 401 head killed in 1894, 363 were cows, 5 oxen, 6 bulls, 2 sheep, 25 hogs. In 1895, to June 1, 230 animals were killed under this board's direction, and 121 in 1894, I think it was. The board is given authority to seize carcasses of affected animals in the slaughterhouses and condemn them, paying the full appraisal value the same as though the animals were killed by the board, and quite a large number of animals have been so seized and condemned. The legislation this year has been in the shape of an additional appropriation, the appropriation having been increased from $15,000 to $25,000.

Texas? Mr. Connell. We have no special law, but we have a State live-stock commission, which is believed to be sufficient for all purposes.

Utah? Mr. Mills. There has been no special legislation. We have a law which provides for the regulation of contagious diseases, but it has never been enforced. There is no officer or organization with authority to enforce its provisions. The only tuberculosis we have known in the Territory has been out around the station, and, with one exception, has been confined to imported cattle.

Vermont? Mr. Hills. The legislature of last year gave us a law which had no limit whatever as to the amount which should be expended. It gave one-half of a disinterested limited appraisal of $40, the full appraisal, to the owner of the animal killed in case it was found to be infected with disease, and the carcass and the full appraisal in case the disease was not found. The law is enforced by the board of agriculture in the State, who have employed several assistants in connection with the tuberculin tests, and the State veterinarian. There have been about 3,700 injections thus far. The law also gives quarantine privileges to all animals coming into the State. The tuberculin-test provision of the law has been executed, and the farmers, without exception, help the commission, and when I left home there was two or three months' work ahead, all of which was at the request of the farmers.

Virginia? Mr. Goodell. Virginia has no law for the control of any contagious or infectious disease.

Washington? Mr. Bryan. The last legislature enacted a law by which the professor of agricultural science was made State veterinarian. He was empowered to slaughter any animal affected with tuberculosis or other contagious or infectious disease.

West Virginia? Mr. Myers. No recent legislation.

Wyoming? Mr. Johnson. No special legislation on the subject of tuberculosis; general quarantine regulations. The application of these quarantine laws is under the control of the State veterinarian.

Mr. COMSTOCK. I ask unanimous consent to address the convention a second time upon this topic.

Consent given.

Mr. COMSTOCK. I stated that we have no veterinarian. There is a Territorial veterinarian and a live-stock sanitary commission, which have all the powers under the law. The last legislature passed a law upon this subject.

The CHAIRMAN. The consideration of the subject is now closed. The Chair will announce the committee on nominations as follows: Messrs. J. A. Myers, Alston Ellis, Austin Scott, E. W. Hilgard, R. J. Redding, J. L. Hills, and T. L. Haecker.

The next item on the programme commanding attention at this hour is "Development and Modifications of the Mouth Parts of Insects," by Prof. J. B. Smith.

(Professor Smith then gave his lecture upon the "Development and Modifications of the Mouth Parts of Insects," illustrated with stereopticon pictures.)

Upon motion, the convention adjourned at 9.50 p. m.

MORNING SESSION, THURSDAY, JULY 18, 1895.

Session convened in "ordinary" of Brown Palace Hotel at 9.30 a. m., President Henry E. Alvord presiding.

The CHAIRMAN. As this is a business meeting, we are ready for committee reports, action on resolutions, business of sections, and other special topics that are to be assigned.

Mr. WELLS. I would move the appointment by the chairman of a committee of three for the acknowledgment of courtesies received by this Association during this meeting.

Adopted.

The Chairman named Messrs. Wells, MacLean, and Anderson.

The CHAIRMAN. Are there any resolutions to be offered for reference to the executive committee? Any business from the sections?

Mr. CONNELL. I desire to offer the following resolution:

Resolved, That a standing committee be appointed from the Section on College Work, whose duty it shall be to report to that section annually the best methods used in the various colleges of the world for teaching the practical and scientific facts relating to agriculture.

The CHAIRMAN. Reports from committees are now in order.

Mr. SCHWEITZER. Your committee to which was referred the duty of drafting resolutions upon the death of Dr. Porter begs leave to report as follows:

Resolved, That we deplore in the death of Dr. E. D. Porter, which occurred after an illness of a few months on January 5 of the present year, at his home in Columbia, Mo., the loss of an active and enlightened member of the Association, whose knowledge and wisdom, joined to great kindliness of heart and indomitable energy, will long live in our memory.

His investigations for the advancement of agriculture are laid down in numerous bulletins; his work as a teacher lives in the hearts of men and women engaged in the successful pursuit of their vocation, and at least two States bear, in the organization of their agricultural colleges, evidence of his work as an efficient and able organizer.

We shall miss him from our councils, and the Association is distinctly made poorer by his death.

P. SCHWEITZER.
A. N. RAUB.
W. M. HAYS.

Adopted.

Mr. WHITE. The committee, to which was referred the president's address, begs leave to report for consideration of the Association the following resolution:

Resolved, (1) That a special committee of three, of which the retiring president shall be chairman, be appointed to codify the resolutions and declarations of previous meetings of this Association concerning uniformity in action on the part of the colleges and stations in matters of common interest, said committee to report at the next annual convention of the Association.

(2) That the executive committee be requested to prepare a circular letter embodying such extracts from the president's address as may be proper to set forth succinctly the objects and utility of this Association, and to forward the same to such colleges and stations as may not now be members of this Association, with a view to securing active membership in the Association of every college and station eligible thereto.

(3) That the executive committee be requested to take into consideration the advisability of assigning a place on the programme of the next annual convention for the discussion of the matters of station bulletins and the participation of the stations and colleges in farmers' institutes, agricultural exhibitions, etc.

(4) That the executive committee be instructed to continue the effort to secure the establishment of an office of land-grant colleges in the Bureau of Education, Department of Interior, on the line recommended by this Association at the eighth annual convention and approved by the honorable Secretary of Interior, it being the opinion of this Association that the provision made for this purpose by the last Congress is inadequate for such an office as was contemplated in the recommendation of this Association to the Secretary of Interior.

(5) That this Association emphasizes the importance of so administering and accounting for the "Hatch" fund as to preclude any charge that it is being diverted from its sole legitimate objects, viz, agricultural experimentation and research, and the dissemination of the results thereof; and to that end heartily indorses, and reaffirms such portions of the report of the committee of this Association, of date October 19, 1887, as refer to this subject.

The committee further recommends that the following resolutions be printed and lie on the table for one year:

(1) That this Association cordially approves and indorses the sentiments expressed by the president in his address, as follows: "It is certain that Congress never intended by land grants or annuities to relieve any State or Territory from the duty of providing its own high schools and grammar schools. * * * The legality of applying the so-called 'Morrill funds' to the support of preparatory departments * * * is to be doubted in any case. In a few exceptional instances the circumstances may justify a land-grant college in making temporary provision for preparing students for its college classes, but the expense of such work should certainly be met from

other funds as soon as possible, and the responsibility of public-school service of all grades thrown upon local authorities. The institutions in affiliation with this Association should in all respects be colleges in fact as well as in name."

(2) That it is the opinion of this Association that the efficiency and success of station work will be most effectually secured and the business affairs of the stations most efficiently conducted by the organization of each station with a single executive head, responsible to the governing board of the institution and representing the station in its relations to the public and to the Department of Agriculture.

The committee, as instructed, has also had under consideration the valuable paper of Director True, of the Office of Experiment Stations, and reports by resolution as follows:

Resolved, That the Association heartily indorses the suggestions contained in the address of Director True upon "Permanent Elements in Experiment Station Work," and that in particular it regards reasonable permanence in the tenure of office of the governing body and the station officers, and the preparation and careful preservation of full, systematic, and accurate records, as essential elements of successful station work.

H. C. White,
C. O. Flagg,
E. A. Bryan,
H. P. Armsby,
P. Schweitzer,
Committee.

Mr. White. I am directed by the committee, Mr. Chairman, to move the adoption of the resolutions.

After prolonged discussion the report of the committee, as presented above, was adopted.

Mr. Wheeler. Mr. Chairman, I have a resolution which I desire to introduce:

Resolved, That it is the sense of this Association that a great saving in the time required for the education of the people of the country might be made, and that the business of the country would be facilitated by the early adoption of the metric system as the only legal standard of weights and measures for the United States; and furthermore, that the country is now as well situated as it probably ever will be for the adoption of this system.

The Chairman. The resolution introduced by Mr. Wheeler is referred to the executive committee, under the rules on the order of business.

Mr. MacLean. I wish to offer the following resolution:

Resolved, That the convention request the executive committee to accept the cordial invitation extended by President Cyrus Northrop of the University of Minnesota, to hold the next annual convention of the Association at Minneapolis.

The Chairman. I understand the motion is offered for reference. The motion is accepted and referred to the executive committee.

Mr. Myers. Your committee, appointed to nominate officers of the Association for the ensuing year, have the honor to present the following recommendations:

For president—S. W. Johnson, of Connecticut.

For vice-presidents—(1) Cyrus Northrop, of Minnesota; (2) J. H. Connell, of Texas; (3) S. W. Robinson, of Ohio; (4) E. A. Bryan, of Washington; (5) R. H. Jesse, of Missouri.

For secretary and treasurer—J. H. Washburn, of Rhode Island.

For executive committee—H. H. Goodell, of Massachusetts; Alston Ellis, of Colorado; H. C. White, of Georgia; E. B. Voorhees, of New Jersey, and the ex officio members provided for by the constitution: H. E. Alvord, of Washington, D. C., the retiring president; S. W. Johnson, of Connecticut, the incoming president, and J. H. Washburn, of Rhode Island, secretary and treasurer.

For bibliographer—A. C. True, of Washington, D. C.

Respectfully submitted.

John A. Myers,
Alston Ellis,
Austin Scott,
E. W. Hilgard,
R. J. Redding,
Joseph L. Hills,
T. M. Haecker,
Committee.

The report was accepted and adopted, and by ballot the officers nominated were elected.

Mr. Patterson. If reports from sections are now in order, I will report the following nominations of officers for the Section on Mechanic Arts for the ensuing year: Chairman, J. W. Lawrence; vice-chairman, S. Fortier; secretary, F. P. Anderson.

The Chairman. It is moved and seconded that the report of the committee on nominations for officers of the Section on Mechanic Arts be confirmed.

Nominations confirmed.

Mr. Gillette presented the following report of officers nominated for the ensuing year in the Section on Entomology: Chairman, Otto Lugger; secretary, G. C. Davis.

Nominations confirmed.

Mr. Voorhees, chairman of the Section on Agriculture and Chemistry, reported the following nominations for officers of the section for the ensuing year: Chairman, C. C. Georgeson; vice-chairman, C. F. Curtiss; secretary, H. J. Patterson.

Elected.

Mr. Georgeson. Your committee, to which was referred the matter of recommending a convenient factor for expressing butter-fat records in approximate equivalent of butter, begs leave to report as follows:

> The ninety-day Columbian dairy test is the most elaborate and carefully conducted on record. In this test 96.67 per cent of the fat in the whole milk was saved in the butter. This butter on the average contained 82.37 per cent of butter fat; in other words, 117.3 pounds of butter were made from each 100 pounds of butter fat in the whole milk. The exact conversion factor would therefore be 1.173. As this is an awkward number to use, and as $1\frac{1}{6}$ is so nearly the same (the difference in computing the record of a 14-pound cow for a week by these two factors being only 0.07 of a pound of butter), it has seemed best to recommend that the latter be used as the conversion factor, and we further recommend that this section recommends to the Association the adoption of the following resolution:
>
> "*Resolved,* That this Association recommends to the several stations that the results of tests of dairy cows or herds be expressed in terms of butter fat, and that when desirable to express these records in terms of approximate equivalent in butter that such equivalent be computed by multiplying the amount of butter fat by $1\frac{1}{6}$."

On motion of Mr. Hilgard the resolution was adopted.

The Chairman. We now proceed to the order of business as printed, being a consideration of the subject named in the programme: "Uniformity of Nomenclature in Station Publications." The discussion of this topic will be opened by Mr. Armsby.

Mr. Armsby. I desire to say that the subject is one that was called to my attention by the chairman of the advisory committee of our station. There is considerable diversity in the nomenclature of station bulletins. They employ various synonyms which are perfectly justifiable, but which are liable to produce difficulty. This gentleman who brought the matter to my attention says himself, "Let me assert it that I found considerable difficulty in ascertaining just what certain stations meant by certain terms." Now, it is obvious that the convention can not at this time take any definite action upon such a question as this. I suggested to the chairman of the executive committee to place it upon the programme, simply looking toward greater uniformity in this particular.

Mr. Hilgard. Do I understand that the object of this arrangement is the adoption of particular terms or a form of printing?

Mr. Armsby. For the use of terms or a system of terminology.

Mr. Hilgard. I move that a special committee be appointed, to report a year hence on the subject named.

Adopted.

The Chairman. The motion prevails; the committee will be named later. The next subject on the programme is, "How Shall We Teach Horticulture," by W. R. Lazenby.

HOW SHALL WE TEACH HORTICULTURE?

I presume we will all agree that particular subjects or special types of studies require special treatment. Language may be taught by one method, botany by another, chemistry by another, engineering by still another. While the methods of instruction in these and other subjects are somewhat varied, there is one general plan which the opinion of the competent or universal experience has pronounced best for each. So there may and should be one best way to teach horticulture.

In solving a problem in geometry or calculus the conditions are ever the same. In horticulture this is not so. The matertials he horticulturist works with are living things and the conditions affecting his work are constantly changing. You can tell a student how to measure and lay off a piece of land, how to build a bridge, or how to make a dynamo. If he correctly follows correct instructions he reaches definite and correct results. But horticulture can not be taught in the same way, because there is nothing exact; there are no permanent conditions. No one can tell why of two equal areas of soil of the same chemical composition and apparently of the same mechanical structure, one will yield a generous and the other a scanty harvest. We can not tell why of two fruit trees of the same variety, receiving the same treatment, one is barren and the other is fruitful.

One fundamental difficulty in teaching horticulture is because of this variation and uncertainty. No strictly practical question in this art seems capable of exact solution.

Another difficulty is the fact that we have little experience to guide us. There were no teachers of horticulture in past generations. Like pioneers, we must adapt ourselves to the situation and develop methods of our own. As beginners I fear we have too often fallen into the mistake of trying to teach horticulture under the guise of the various sciences closely related thereto. However close the relationship, and however necessary as a preparation, these sciences are not horticulture. All the science in the world, while it might powerfully help, could not of itself cause any young man or woman to become a skillful fruit culturist, florist, nurseryman, or landscape gardener.

Horticulture is an art and must be taught as an art. It can only be mastered by training and practice. If we are teachers of horticulture, we ought to teach the art of horticulture.

Botany and chemistry may teach much regarding the growth and feeding of plants, but they do not teach how to select varieties, propagate, transplant, cultivate, fertilize, prune, or, what is often still more essential, how to harvest and market the product to the best advantage.

Horticulture may be compared to a wheel in which the hub or foundation of the structure may represent an ordinary English or common school education. The spokes radiating from the hub may represent the various sciences, geology, chemistry, botany, physics, physiology, entomology, meteorology, political economy, etc. But a wheel consisting of hub and spokes alone is not a very useful structure. It needs the felly and tire, and these may represent technical training by the scientific method.

In teaching horticulture, therefore, it should always be considered an art whose true substantial base is science.

But the question before us is, How shall we teach this art?

The problem, stated briefly and in a very general way, is this: Given a class of from six to twenty students, varying from 16 to 30 years of age, who are to receive instruction from two to six hours a week for from one to six or eight college terms, to find the best possible division and methods of work for the following ends: (1) Technical training; (2) acquisition of knowledge; (3) intellectual culture.

The main factors which enter into this problem are (1) that the students possess very unequal ability and attainments, especially in a knowledge of the elementary principles of the sciences; (2) that some can remain only part of a year, others one year, others two, while a small percentage will complete the course; (3) that the students require instruction and training adapted to their ability and needs each successive term, thus permitting progress; (4) that the equipment and facilities for thorough technical training are usually scanty and wholly inadequate for the work to be done.

It is also to be kept in mind that in a course, department, or school of horticulture the question involves the best possible training and instruction, not in the art of horticulture alone, but in those other branches which are essential to a well-rounded education.

In the Ohio State University, of which I have the honor to be a representative, instruction in horticulture is required in three distinct courses of study, viz, in the four years' course in horticulture and forestry, the four years' course in agriculture, and in the two years' course in agriculture. There are six distinct courses of instruction offered, as follows: (1) What is termed "The elements of horticulture;" (2) vegetable gardening, including the winter forcing house; (3) small fruit culture and the nursery; (4) pomology and viticulture; (5) arboriculture and forestry; (6) floriculture and landscape gardening.

The work in the elements of horticulture is almost wholly practical and is done in the laboratory, greenhouse, and gardens. It consists, for example, of such subjects as the mechanical examination and testing of seeds; propagation by seeds; transplanting, irrigating, pruning, budding, grafting, cross fertilization, judging vegetables and fruits, and similar topics.

The more important basal or fundamental operations in horticulture, like those named above, are selected because their successful performance requires technical skill and a knowledge of the elementary principles of science. The skill is acquired by practice, and the necessary scientific knowledge has already been gained, for before entering upon this course the student is expected to be well prepared in agricultural chemistry, botany, geology, and physics.

The practical work of this course is supplemented by one or more lectures a week on some more general topics. The following are illustrations of some of the subjects treated: "A historical sketch of horticulture;" "Different divisions of the art;" "Its relation to science;" "The advantages of horticulture as a profession;" "Location for horticultural work;" "The great horticultural States of the Union;" "Horticultural organizations;" "Some of the successful horticulturists of the United States." It will be seen that these lectures have no direct reference to the special technical work in hand. Their object is to convey knowledge and to inspire a respect and enthusiasm for the art. They give the student a broader, truer conception of the real meaning and mission of horticulture, and show him that he is entering upon the study of a grand, useful, and ennobling industry.

Another feature of the work of this course which was introduced last spring is the keeping by each student of a daily journal, in which is briefly recorded the more important operations and incidents of each day's occurrence in the department. In these journals notes were made regarding the weather, the date of planting, cultivating, and harvesting the principal crops; the time of blooming of the garden and orchard fruits; the appearance of weeds, insects, and birds; the amount of product sold and prices received, etc. These daily calendars or record books were examined every Monday, and suggestions for making them more complete and useful were given from time to time. This keeping of a daily journal was a signal success, and I believe its value can scarcely be overestimated. It developed the faculty of observation and elicited an interest in the various divisions of the department that was an equal pleasure and inspiration.

This course in elementary horticulture which I have briefly outlined may not be the wisest or the best. I believe, however, that it has some good features and is fairly well adapted to the conditions existing at our State university. While it is more or less complete and self-contained, and is thus adapted to those who can spend only a year or less in the study of horticulture, it forms an excellent preparation for the courses which succeed it.

The special points I would urge in its favor are, (1) that it is a flexible course of study, and (2) that it serves the three distinct ends of education, viz, technical training, acquisition of knowledge, and mental discipline.

I will not weary your patience by discussing the methods of instruction in the succeeding courses. In these the number of students is smaller, and thus far the plan of individual instruction has been largely followed.

It may be thought by some that the demand for horticultural education and training is not sufficient to give it an extended place in the curriculum of our land-grant colleges. It should be remembered that while horticulture is one of the youngest, it is one of the most rapidly developing arts in this country. The fruit interests alone of States like California, New York, Ohio, Michigan, and others are great and constantly growing.

The forcing of winter vegetables and the cultivation of finer products of the garden are rapidly extending and are becoming more and more profitable. Commercial floriculture is developing with marvelous rapidity and bids fair to soon become one of the most important branches of horticulture. According to the census of 1890 the annual product from this business is over $26,000,000. The Society of American Florists, one of the strongest distinctively horticultural organizations in this country, has for years persistently urged the importance, the necessity, of a school or department of floriculture. It is doubtful if there is any industry of equal extent and usefulness so entirely wanting in opportunity for advanced study and scientific training. With the exception of the Shaw Botanic Garden—and there the number of students is limited to six or eight—I know of no place where the practical florist can turn for guidance and instruction. I have received letters the past year that testify that young men and young women are looking toward floriculture as a vocation which offers many and signal advantages. It is an industry especially adapted to women, and several thousands are already engaged in it. We should also realize that a general home interest in flowers and ornamental gardening is rapidly developing.

It will thus be seen that broad and liberal horticultural instruction embraces many different divisions, and our departments of horticulture should be prepared to meet the growing demands.

One very essential feature in the way of needful preparation is a better material equipment. It is possible that this department in a few highly favored institutions like Cornell, the University of Wisconsin, the Agricultural College of Michigan, and perhaps one or two others, have all that could reasonably be expected or even wisely desired. But I am quite sure this is not the situation in many other land-grant colleges. Some, I am pleased to say, have fairly good facilities for teaching and illustrating pomology, small-fruit culture, and vegetable gardening. But how many have well-equipped divisions in floriculture, landscape gardening, or forestry? Without the proper equipment but little can be done along these lines, yet their importance can scarcely be overrated.

Although the opportunities for studying horticulture in its various branches are better than ever before, the appropriations for the use of these departments in our various colleges have been, as a rule, wholly inadequate for anything like good equipment and broad, progressive work.

Under reasonably good management a college or university advances and prospers just about in proportion to the means at its disposal. Its progress depends mainly upon the capital it can command. If this be true of the college or university as a whole, it is no less true of each particular department.

If one department has two or three times the means at its command that another has it ought to advance or develop twice or thrice as fast. While it may require more to equip one department than to equip with equal completeness another, there is less difference than may appear at first sight. The actual difference in requirements in the different technical departments is comparatively slight.

The amount of capital necessary to thoroughly equip and conduct a well-appointed department of horticulture is just about the same as that necessary to equip the agricultural department or the department of mechanic arts.

It has been asserted that we do not need this expensive equipment and enlarged facilities until we have the students. But the fact is we shall never have the students until we have the facilities. How many dairy students did we have in the various colleges until thousands of dollars were spent in thoroughly equipping and furnishing our dairy departments?

I do not understand that there is now any lack of students in our dairy schools where they are amply and generously supplied with facilities for instruction.

So it will be in horticulture. Given a properly equipped department or school and the students will be on hand. I urge upon the trustees and presidents of our different State colleges or universities, and especially upon those connected with horticultural departments, to demand large things for horticulture. We have a right to so demand. Education by the State is something more than a business enterprise or mere commercial speculation. True education is based upon philanthropy. It is the duty of the State to provide and extend it; to furnish the education adapted to the needs of our citizens, be the demand great or small. The cultivators of the soil outnumber all other classes of our population. Never before in the history of our country have so many small holdings of land been used to such advantage. In these times of business depression, many are anxiously seeking for instruction in the various branches of horticulture. Institutions founded for the special purpose of providing the industrial classes a liberal and practical education in the various pursuits and professions of life ought not to neglect those which engage so large a number of our citizens. It is true that many who desire this education can not come to our colleges and universities. Fortunately, the whole tendency of modern educational methods is toward bringing the results of education and training before the whole people.

Our mission as teachers of horticulture is first to teach those who come and join our classes, and second to give as much instruction as possible away from the college, choosing those places where special needs exist. What do the people of my State most need to know in the way of horticultural instruction is a question we should keep constantly before us. We can and ought to do some good missionary work at our farmers' institutes through our State and county horticultural societies and university extension methods. I believe that no class of our population is giving more earnest, original thought to the different economic problems connected with the successful cultivation of the soil than are the horticulturists of our country. I am certain that no class is more eager to receive the instruction and inspiration of science.

Permit me to call attention to a new line of work inaugurated and put in operation the present season by the horticultural department of the Ohio State University. It is the judging of samples of standard and new varieties of fruit, flowers, and the finer products of the vegetable garden. Just a bare beginning has been made in this work, but it promises to become a useful feature of the department. Briefly outlined, the plan is this: Professional and amateur growers of fruit, flowers, and vegetables are invited to send samples of the same to the university, where they are carefully examined and judged. By this means we expect to be able to learn what sections of the State produce horticultural products of the finest type and who are the most skillful growers. It will give our students an opportunity to become acquainted with different varieties and with the effects produced by variations in soil, climate, exposure, and different methods of culture upon the same variety. It will tend to stimulate the selection of better varieties and the production of finer specimens. Above all, it will keep those interested in horticulture in touch with the university. If the work of judging should become too burdensome, it can easily be restricted to certain classes of products.

Although, as already said, this is a new feature, I believe it will prove of great value to the horticultural interests of our State.

I close this suggestive rather than exhaustive paper with the avowal of a joyful trust that the future of American horticulture will evince rapid and marked improvement over its past, and that the earnest, intelligent efforts of the workers in our agricultural colleges and experiment stations will impel it toward a perfection such as we have scarcely dared to dream. If those of us who love the art will intelligently resolve that we will do our share in its advancement, it will not be long until we have a horticulture that is worthy of our country and worthy of the age in which we live.

The CHAIRMAN. Before proceeding with any discussion of this paper it may be desirable to state that the Section on Mechanic Arts asks to have its time assigned to this programme postponed until this afternoon, and at that point upon the programme we will have presented the paper of Mr. Hilgard, on "The Distribution of Salts in Alkali Soils."

Mr. BRYAN. I merely want to ask Mr. Lazenby of what the equipment of a horticultural station should consist?

Mr. LAZENBY. They should have an equipment of a greenhouse, and I think also a laboratory where work can be carried on irrespective of the weather.

Mr. GOFF. In my own work, in giving instruction in horticulture, I have found some difficulties. We have one class made up of students belonging to our four years' college course. These students come to us at the end of the second year; they have had some considerable training in natural science; with them it is a comparatively easy matter to give profitable and interesting work in horticulture. But we have another class, which in our institution predominates, that is made up of boys who come to us from the farm and from the district school. They have had no higher training than such as can be had in the district school. They know nothing of botany; they are not accustomed to assimilating lectures; they are not accustomed to taking notes; they are not accustomed even to pursuing abstract thoughts, and it is with this class that I have been compelled to exercise my ingenuity. My first attempt was by lectures, but I found that this was not a marked success; for a time they were interested; later some of them seemed to become drowsy. While I tried to make my matter as elementary as I could, I found that I was failing to reach a part of them. I go on the assumption that inasmuch as the young student is without the knowledge of botany, without much knowledge of physics or chemistry, I can do more for such a student by beginning and teaching him a few elementary principles of science and then helping him to apply those principles to practical work than by beginning at the other end and pounding in a lot of desultory facts; and I find, also, that it is much easier to interest this class of students with their hands than it is with their ears, and this led us to found a department which we call "Horticultural laboratory work."

Now, I have said that I begin by stating a few of the principles that underlie the science of horticulture. I am careful first not to state those principles in a forcible manner. To illustrate what I say specifically, I want to teach a student in regard to the germination of seeds; I first state this principle, that seeds in order to germinate must have oxygen, but the real emphasis of this principle is given through a little experiment which I have each student perform for himself in the laboratory. I have attempted different methods in demonstrating this principle, but the one which I find the most useful is this: I give each student two flowerpot saucers; these saucers I first wet; then I give each student a small quantity of our loamy clay soil; I also give each student a small quantity of sand and a few seeds, and each student has a place at the laboratory table. Now, I instruct the student to take a small quantity of this wet soil and flatten out a quantity of it and place it over the bottom of his flowerpot saucer. I next instruct him to put on, say, twenty navy beans upon this moistened soil and place over the seeds another layer and carefully press the soil down about the beans. Then I have him treat the other saucer in the same way, using sand instead of loam. These we put in a greenhouse in a place where the air is moist and leave until the next day or the second day. Then I have the student examine this little experiment; he finds out, very often to his surprise, that the beans between the puddled loam have not germinated, while the others have germinated nicely. I find that it excites a good deal of interest on the part of the students, and various reasons are offered, but soon the right one is generally hit upon, and then we have the principle established in a way which will never be forgotten, that a seed if planted in a way that the air can not have access to it, will not germinate.

Now, I say to the students, "If you have some beans to plant in your garden, will you plant them at a time when the soil is very wet, or only moderately wet?" Then I ask them, "If it were necessary to plant when the soil is very wet, would you pack it down, or would you put it on lightly?" They are able to answer this question from their thought; they understand it now, and they understand the reason. I carry this system from the teaching of a first term just as far as possible; we do not, of course, confine it to seeds, but to the development of roots, etc. Then, there is another question of laboratory instruction that is different from this. This one, you see, is intended to demonstrate the principles; the other is intended to instruct in the art of certain processes in horticulture in which skill is necessary in addition to knowledge. For instance, in the manufacture of root grafts: First we show them the model of a graft, and explain it to them; let them handle it, and have them observe carefully the manner in which the cuts are made. After they have thoroughly examined it, then we give them the tools and grafting knife, the scions, and the seedlings, and, first, with very careful instruction, have each student make a few grafts; after that, as an inducement to practice the work, we furnish them the materials and allow them to graft a certain quantity on shares. We give them a certain percentage for their work, simply to interest them in it; and it is a matter of pleasure to us to receive letters from our students, telling us how much they have grafted, and the profit they have made out of it. We are constantly finding that we are needing more apparatus. Most of this apparatus is not of an expensive kind. With the exception of our magnifying glasses, which, perhaps, are our most expensive minor apparatus, it consists of such things as flowerpot saucers, flower cups, a little pair of accurate scales, and things of that kind, which will enable the students to do their work. In our winters in Wisconsin the ground is frozen from early in December very often until the 1st of April. In order that our students may be taught something of the practice of horticulture in the open ground, we have provided a plat expressly for this purpose. There we give our students instruction in making hotbeds, the planting of root grasses, the hilling up and protection of shrubs, etc. We are finding these houses very useful indeed in our sectional work.

Mr. CARD. Previous to this year we had not made much progress in horticulture, especially in the line of laboratory work; this comes from the fact that our laboratory was not open and fully equipped. Of course we can supplement that to a certain extent with greenhouse work. We find this especially so in our own case, because we have one regular course in greenhouse work, and those students are well able to handle the greenhouse work. Of course students who enter in the middle of the year can not take the same interest in it. In my own work this year I have tried to provide for irregular laboratory work. In another line of work I have found what may be termed seminary work of advantage and tried it during a term; the next term we combined that with laboratory work. The difficulties must be overcome at every one of those periods; if there is work at the farm, we take them there and go through with that work; otherwise we have to do this seminary work, and instead of spending time in experimenting, the students are given a topic and turned loose among the books of the library to hunt up and rummage through the literature relating to it. Now, while that is the most satisfactory method of getting students, it is not the most satisfactory way to educate students. It has worked admirably along the line of forestry this year. I usually recommend a slip system to the student for keeping his notes, so that they are arranged alphabetically. Now we are, in our work, coming to the plan of garden herbariums, not only in the matter of teaching, but in experimental work; we know that most of our students are unfamiliar with many varieties of plants and know nothing about them, and if we have these specimens to show them it is a great help. The camera and the darkroom are the next necessary equipment of a horticulturist's office; as a recorder of results to place before our class, they do a work which instruction can not do. The less instructing we can give the better. Give experiments. For instance, one topic was the treating of the poison of plants; another of evaporation beds. One was mulched, one was left untouched, packing without stirring; but though these were not accurate experiments, they were useful to the students in that they were getting information from it all the time. The greatest trouble comes, of course, from the younger students, those who have had no training. In my own case at least the horticulturist is not capable of teaching plant physiology. We give next year a course of plant physiology adapted to horticulture. That will only be given to those who have had botany.

Mr. RANE. There is no system at the present time upon which we can all unite in teaching horticulture. Every one has his own ideas in teaching. It seems to me that, in the first place, we should in every instance base our horticultural teaching upon botany. But I find one great trouble is that the students are never prepared for taking up horticulture; they have never had sufficient training in botany to take up the horticultural work. It seems to me that the botanists might develop some system of teaching botany better adapted to preparing students for a course in horticulture. Now, this work that Professor Goff speaks of could be done to a great extent in our country schools. We have, especially in our agricultural colleges, men not prepared to take horticulture. In our institution Dr. Myers, who is director of the station, is glad to have me bring horticulture men into the station; therefore we turn our station work into the laboratory for their instruction, and many of the young men are receiving training every day during the year in taking up work along this line. I think this is one way in which we can take up the horticultural work—along the line of laboratory work in experimental work. As for the two classes of men, we must have, if we continue to seek students, those who take the four years' college course, and those who take the short course Professor Goff speaks about, and I think this laboratory work should be arranged for, either in preparatory years or should be begun before they are thrown into the general college courses. If they take up this sort of investigation or laboratory work, they should take up some additional work—some sort of scientific herbarium work. We must begin with some kind of system.

The CHAIRMAN. The next topic on our programme is the paper of Professor Hilgard, on "The Distribution of Salts in Alkali Soils."

THE DISTRIBUTION OF SALTS IN ALKALI SOILS.

As time progresses the importance of the alkali question—i. e., dealing successfully with the cultivation of lands more or less largely impregnated with soluble mineral salts—becomes more and more obvious. It is to be greatly regretted that the mistaken efforts of landowners to suppress or at least to ignore this matter, for fear of injuring the selling value of their lands, interpose additional difficulties in dealing with an intrinsically sufficiently difficult problem. In view of this circumstance we bear patiently the disappointment we have undergone in finding that, unexpectedly, one of our geographically most important culture experiment stations is located upon ground subject to all the difficulties inherent in the cultivation of alkali land; we are thus enabled to study the problem independently of any private interests.

The culture experiment station near the town of Tulare, originally intended to represent the upper San Joaquin Valley, has thus instead become the station for the study of the alkali problem in all its phases, from the mildest to the worst. Until this problem is solved, no certain conclusions for the region at large can be drawn from the cultural results observed there, since we know that all the vegetation on the station grounds is under more or less stress from the alkali in the soil. If, however, we shall be successful in overcoming this influence—as we hope to be—the station will have rendered, not only to the San Joaquin Valley and the State at large, but to the entire region west of the Rocky Mountains, a most important service.

For an understanding of the situation it may be necessary to restate here that in their natural condition the lands for several miles around the station, as in hundreds of localities elsewhere in the valley and the State, show only occasional alkali spots, while outside of these spots, during the spring months, the country is covered with a luxuriant growth of native (largely annual) herbaceous plants, many being showy flowers and affording a most attractive sight; also proving beyond question the great inherent fertility of the land. As the season advances, from April to June, those plants go to seed or dry up, leaving the land more or less bare, or with only a sparse growth of hardy, drought-resisting, partially perennial plants. There is not in ordinary seasons any perceptible increase or decrease in the area on the interspersed alkali spots.

When such land is put under cultivation without irrigation, it will in years of unusual moisture bring very heavy crops of grain, which easily make up for at least one other season of almost total failure, when the rainfall is light or unfavorably distributed. It is this "fighting chance" of a highly remunerative crop that has in so many cases induced the investment of entire fortunes in such ventures, frequently with a total loss and financial ruin as the result; a kind of agricultural gambling, little better in itself, and with as many chances against success, as that at the faro table, but now happily almost a thing of the past.

With the advent of the irrigation ditch the heavy grain crop becomes for a few years a matter of certainty. Then there is a gradual change for the worse. First it is noticed that the alkali spots increase their area outward, often merging neighboring small spots into one large one. Then new ones begin to appear, at first "no larger than a man's hand," but enlarging each year and finally often so cutting up and reducing the producing area that the land is abandoned in disgust.

The "rise of the alkali" thus brought about by irrigation was very generally at first attributed (and sometimes justly) to the saline character of the irrigation water used. But as in time it became apparent that even the purest waters, such as those of Kings and Kaweah rivers, would produce the same result, the conclusion that the alkali salts are simply brought up by evaporation from the soil itself forced itself upon the most superficial observers.

Then arose the question, How much of these salts does the soil contain, or where do they come from? If it could be shown that the soil, subsoil, and substrata were equally impregnated with alkali and would continue to supply indefinite amounts, the reclamation of such lands for permanent cultivation would be almost hopeless.

We at first approached the problem by the examination of "bottom waters" in cases where the latter had risen from a considerable depth in consequence of a filling up from leaky ditches. It was found that in the vast majority of cases such water contained relatively small amounts of alkali salts only; not more than many waters successfully used for irrigation. It thus became evident that the main mass of these salts exists in the soil and subsoil within a few feet of the surface. The chemical examination of the "alkali," moreover, showed that it consists, as a rule, of such compounds as are known to be formed in all soils in consequence of weathering, and that it contains all the ingredients useful, as well as those useless, to plant growth; substances which in rainy countries are currently leached out and carried out into the country drainage and finally into the ocean, but which in regions of scanty rainfall remain in the soil mass.

We are thus led to the vitally important conclusion that the amount of the salts in these lands is but limited; and if once removed or rendered innocuous to crops in some other way, it will take thousands of years in the future, as in the past, before another such accumulation can occur from the very gradual weathering of the soil mass.

In view of the extraordinary intrinsic and permanent fertility of alkali lands when once reclaimed, it has seemed desirable to study in detail the manner of the distribution of the soluble salts, as well as their kind, at different depths in the soil and at different seasons, so as to gain an insight into their migrations and transformations, and thus determine the best and cheapest methods of dealing with them.

The problem is a very complex one and involves a great deal of labor, hence can not be solved in one or a few seasons, because of the great diversity of soil conditions. The investigation has already, however, yielded such striking and practically important results that it seems best to bring them to public notice at once.

For more ready understanding, these results are platted so as to show by means of curves, or lines drawn from point to point of actual determination, the increase and decrease of the total soluble alkali, as well as of the several salts composing it. As will be seen on the face of the plate, the samples were taken (by means of a posthole augur) so that each represented a vertical column of 3 inches of soil, continuing thus to the depth of 4 feet. Each of these samples was then leached of its salts and every leaching analyzed separately. It was at first attempted to leach only the average of each foot, but this proved quite unsatisfactory.

In the diagrams the depths are shown by horizontal lines at intervals of 3 inches, as marked on the margin to the left, while the vertical lines represent differences of two hundredths of 1 per cent in the saline contents of the soil layers, as marked at the top of the diagram, increasing from left to right.

Inasmuch as each sample represented the average of 3 inches of soil in vertical depth in drawing the connecting lines or curves, the result of the analysis is assumed to represent the middle portion of each 3 inches. Hence the changes of direction always appear as occurring in the middle, vertically, of a 3 by 3 inch square. The area embraced between each curve and the vertical line to the extreme left represents, of course, the aggregate amount of each ingredient enumerated, viz: Common salt, Glauber's salt, and salsoda as the chief ones, with Chile saltpeter (nitrate of soda), also mentioned on account of its fertilizing value.

The predominance of carbonate of soda seen in these diagrams shows at once that the Tulare alkali is very "black," so that the use of gypsum is the first thing needful in attempting any reclamation or preventive measures. But aside from this, the diagrams suggest very instructively the explanation of many points not well understood heretofore.

Effect of the rainfall.—It is well known to residents that in Tulare and northern Kern counties the greatest depth to which the soil is wetted by the winter rains rarely exceeds 3 feet. This, then, is the depth to which the soluble salts in the soil may be washed each successive year by the natural rainfall; and from this depth it may partially or wholly reascend toward or to the surface during each dry season. It is reasonable to expect that near the lower limit there will be a gradual accumulation of the saline matters, which reach it in the form of strong solutions. Fig. 1 illustrates this strikingly. It shows the condition of the natural, unirrigated land at a point half a mile north of the experiment station, which was at the time covered by the native spring growth of herbage and flowers, and which during the dry season shows no signs of alkali on the surface. Evidently, at the time represented

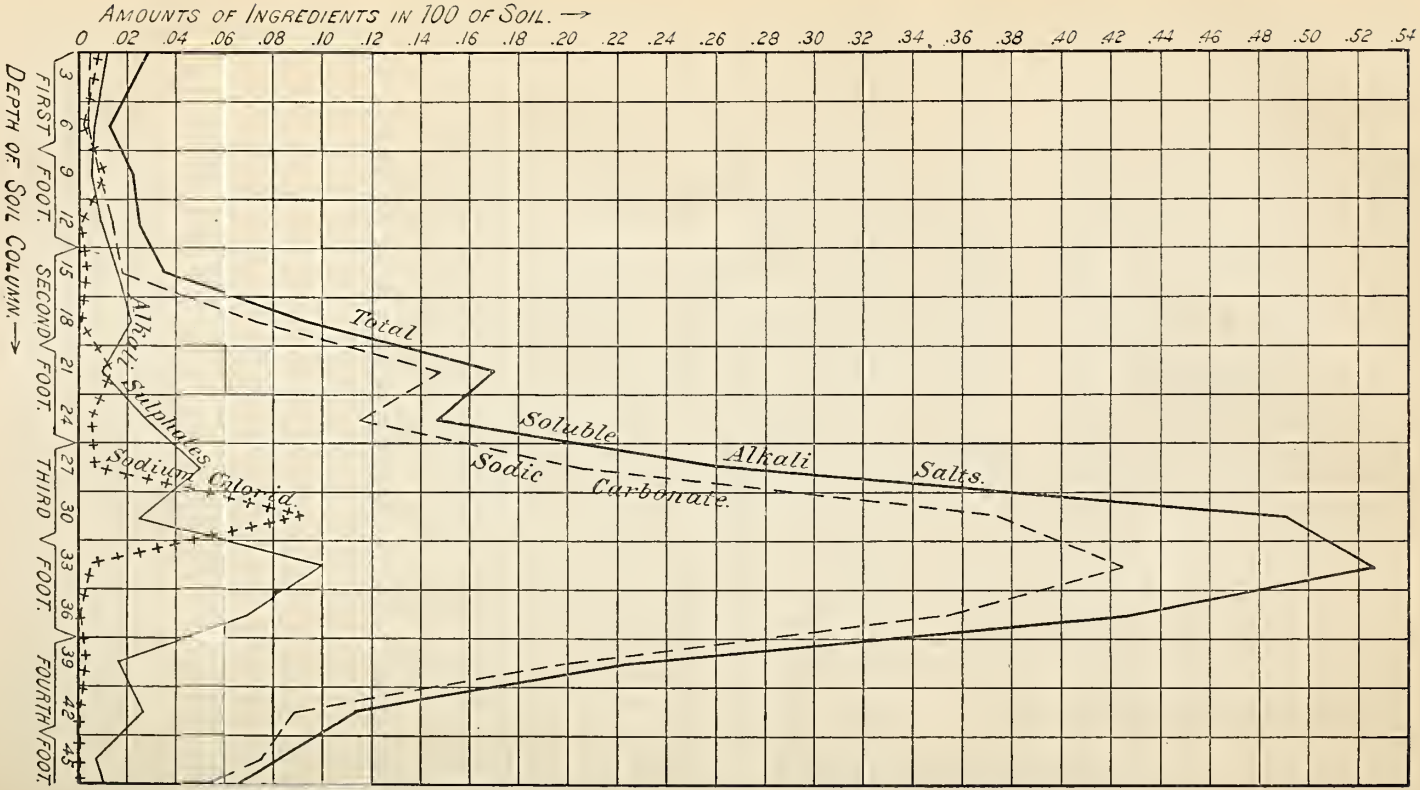

FIG. 1.—Average composition of alkali salts at various depths in unirrigated alkali land at Tulare Experiment Station, California, March, 1895.

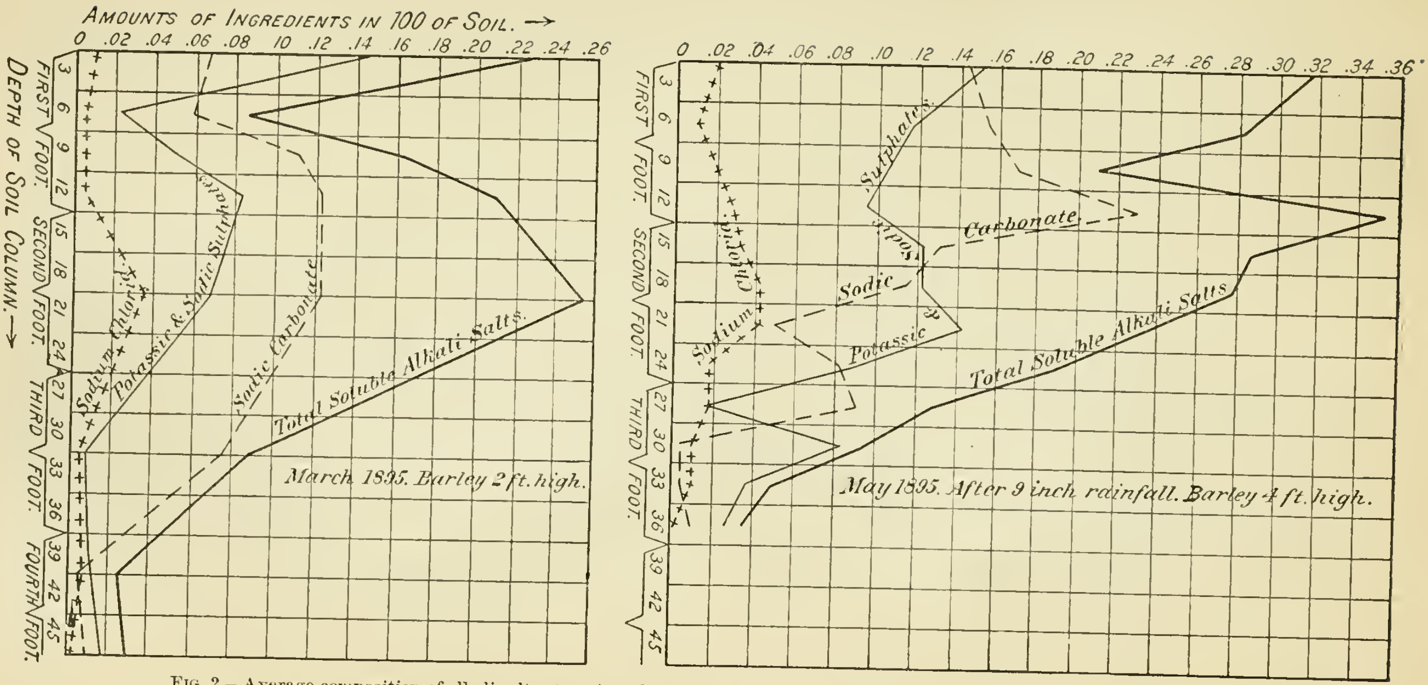

FIG. 2.—Average composition of alkali salts at various depths in partly reclaimed alkali land, Tulare Experiment Station.

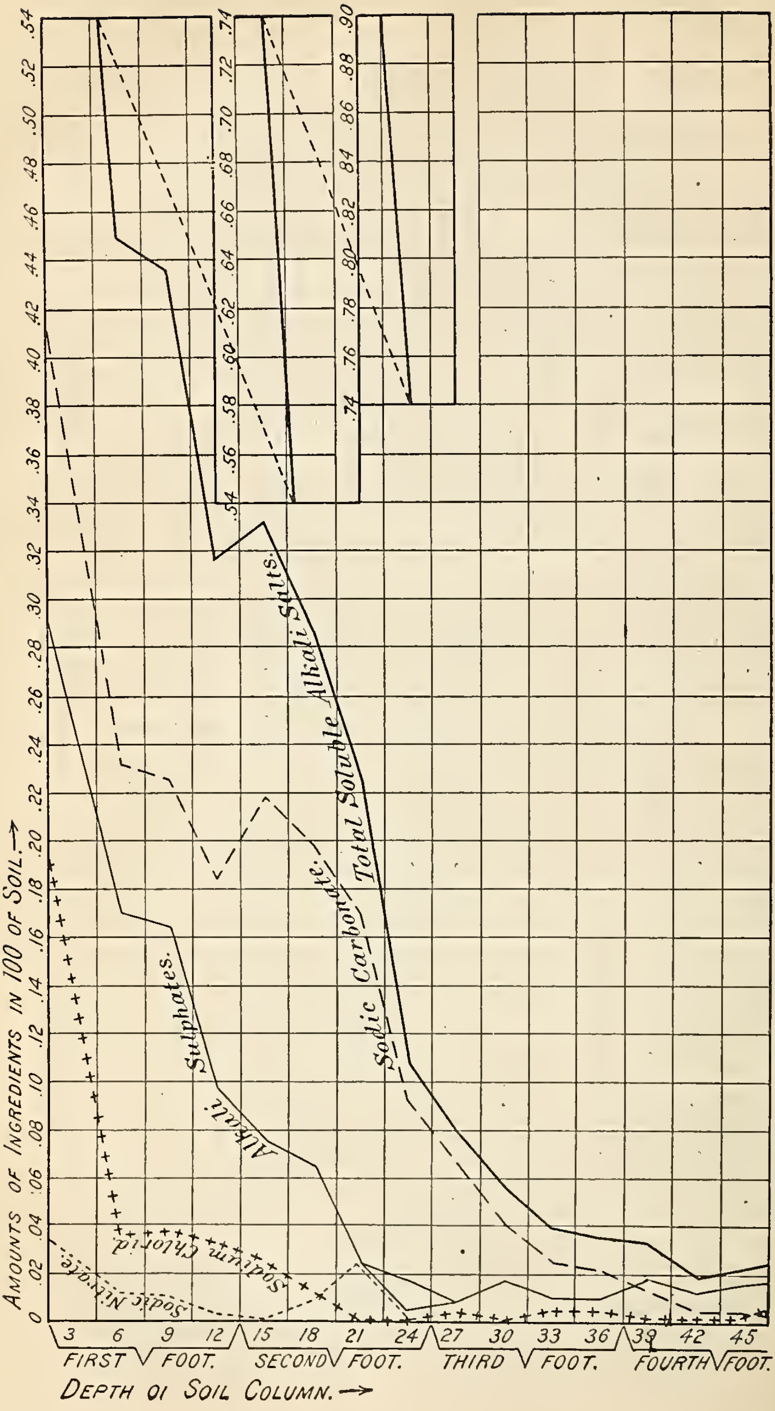

Fig. 3.—Average composition of alkali salts at various depths in bare irrigated alkali land, Tulare Experiment Station, May, 1895.

here, the winter rains had washed the alkali salts so far down into the subsoil that the seeds had no difficulty in germinating near the surface, and as the growing herbs covered the surface, practically all the evaporation took place through the roots and leaves, and the alkali did not move upward to any great extent. The roots only reached to the level (18 to 24 inches), where the impregnation is not strong enough to hurt them. The soil moisture being pretty nearly exhausted by the evaporation through the plants during their growth, evaporation from the soil could not thereafter bring any perceptible amount of salts to the surface. Thus the first rain would next season again enable the seeds to germinate without injury from the alkali, despite the heavy impregnation farther down, which is seen to be greatest about the last half of the third foot.

As a matter of course, not only the native growth, but also any crop of which a good stand has been obtained on an alkali soil, will similarly tend to diminish or prevent the rise of the alkali. Hence a crop of alfalfa, once established, may flourish for years on ground that, so soon as it is left bare during the dry season for the fall sowing of a grain crop, may prove altogether too strong and may kill the grain.

From the 15-inch level down we see a sudden and very rapid decrease of the salts, so that toward the end of the fourth foot they are reduced to a little more than is shown at the end of the first foot from the surface.

Those familiar with "black alkali" lands will at once recognize the 3-foot depth as the one at which in punching or digging post holes or ditches a very tough, intractable clay hardpan is frequently encountered, which, when exposed to the air, soon becomes covered with abundance of white salts. This is the cause of the thick layer of salts often seen alongside of irrigation ditches in the alkali regions.

We see thus demonstrated beyond any possible cavil the correctness of the conclusion we have previously drawn from the examination of the bottom waters, viz: That the bulk of the alkali salts is even in natural alkali lands accumulated within easy reach of the surface and of underdrains, and that if this accumulation is once removed, no more, or at least not enough to do any harm, will come from below. This points to underdrainage as the ready and complete corrective of all alkali, as has been long ago recommended by us.

But it does not follow that the indiscriminate use of underdrainage is to be recommended, since, as we have abundantly shown, enormous amounts of valuable soil ingredients would thus run to waste. In the majority of cases other means, presently to be referred to, will accomplish the reclamation.

Effects of cropping.—Fig. 2 shows the effect of a growing crop on the same land as that in fig. 1 within the station grounds, the two samples having been taken within 5 feet of each other; but a heavy dressing of gypsum had been applied, with good irrigation, and barley was sown in January, 1895. Some rather abundant rains fell afterwards, which naturally leached the alkali salts away from the surface, so as to leave it quite weak within the first foot. Evidently the barley germinated and made its first growth under these conditions, but as it failed to cover the ground, some surface evaporation took place and the alkali began an upward movement, the effect of which in increase of salts at the surface is seen in both figures, but modified in the latter one by the contrary effect of a light, late rain, which diminished somewhat the salts at the surface. The two profiles are clearly the transition phase between the natural condition of the land as shown in fig. 1 and that of an alkali spot as exemplified in fig. 3, and illustrates well the effect produced upon evaporation and the consequent movement of the alkali salts, even by a cereal crop, with its shallow roots and thin foliage. It is obvious that a crop of alfalfa, once established upon this land and bringing to bear upon it the action of its deep roots and dense shade, would by the repression of surface evaporation, tend to restore the natural condition as shown in fig. 1.

Effects of irrigation.—Let us now see what effect irrigation, or the establishment of leaky ditches in a pervious soil, will produce in land circumstanced as shown in plate 1.

As regards the latter case, anyone can see for himself that as the ditch water, filling up the land from below upward, comes in contact with the alkali-sodden subsoil or hardpan layer it will dissolve the salts and carry them up toward the surface. Evaporation from the moistened surface will then go on all the year to a greater or less extent, and the alkali will keep steadily moving upward until in the course of a few years the maximum will be found, not 3 feet below, but right at the surface. This is one phase of the "rise of the alkali," very easily understood in the light of fig. 1; and its extreme outcome is graphically shown in fig. 3, which scarcely requires comment.

This diagram shows the condition of land originally similar to that represented by fig. 1, which has been irrigated for four or five years, and quite lately has also been influenced by a neighboring leaky ditch outside of the station inclosure. Here we see that the alkali has moved bodily upward, and has accumulated near the surface to such a degree that any useful growth of ordinary crops has become impossible. Seed sown (except those of salt bushes) are quickly corroded or "rotted" by such alkali as this, and fail to sprout; anything set out ready grown may live while the rains last, but will be promptly killed by the corrosion of the root crown, or lower end of the stem, from the effect of the strong solution formed around it whenever a light rain or heavy dew falls, even if the root should be able to resist the action of the alkali in the soil itself.

It is not quite so easy to understand why surface irrigation should produce the same general result as the rise of the bottom water from below; and yet a little consideration readily explains it. Under irrigation the land received many times more water than in its natural condition, but rarely enough to leach the alkali salts into the country drainage. Practically all this irrigation water, therefore, ultimately evaporates in the course of the year. As it penetrates the soil to a greater depth than the natural rainfall ever goes, it completely dissolves the alkali salts in the subsoil, and in the progress of its evaporation throughout the season, carries them with it toward the surface, instead of leaving most of them accumulated at between 2 and 3 feet depth, as in their natural state. In the course of time, especially in orchards where the soil remains bare, therefore exposed to evaporation throughout the season, the accumulation near the surface becomes so great as to injure even the bark of full-grown trees and vines, while ordinary herbaceous vegetation becomes impossible. If the alkali should be of the "black" kind—i.e., carbonate of soda—the soil will soon begin to settle, and puddles of inky water will remain for some time after rains or irrigation, and sometimes form permanent "alkali ponds," with a bottom of tough, impervious hardpan.

That these worst effects can be suppressed by the conversion of "black" alkali into "white," by means of gypsum, I have already sufficiently explained in former publications. The "white" or neutral alkali is many times less injurious than the "black," which is so corrosive that it dissolves not only the humus of the soil, but also the bark of plants; always excepting the wonderful "saltbushes" and their kind. But there are limits, varying for different plants, beyond which even the white alkali becomes incompatible with cultivation, so that its accumulation near the surface must be prevented as much as possible. Fig. 3 shows the conditions of bare irrigated land in May; at the end of the dry season we find nearly the whole of of the alkali concentrated within less than a foot of the surface, and if we could afford to remove that first foot of soil, we would have no more trouble from alkali; but we would have seriously damaged the land's productiveness.

Counteracting evaporation.—From what has been said, it is obvious that since evaporation from the soil surface is the cause of any "rise of the alkali," one of the chief preventive measures must be the reduction of surface evaporation to the lowest possible point. This can be done either by mulching, or, less effectually, by shading.

The best mulch, available in all cases, is a well and deeply tilled surface soil on which a crust is never allowed to form. Then evaporation will be reduced to the minimum, and whatever does take place leaves the alkali distributed through the whole of the tilled layer instead of at the surface, where the bulk of the damage is usually done. For a loosely tilled soil will take up little or no moisture from a denser or more compact subsoil, which it protects quite as effectually as would a straw mulch.

Of course the depth or thickness of this protective tilled layer is of the utmost importance, not only for the sake of preventing evaporation and accumulation, but also because, since the maximum of alkali in irrigated land at the end of the dry season is always near the surface, the intermixing of the strong surface alkali with as large a mass of subsoil as possible is important in order to dilute and diffuse it, so that it may not be strong enough anywhere to hurt the root or root crown. After such an intermixture, say to the depth of 10 or 12 inches, it takes some time to bring the salts to the surface again to a sufficient extent to hurt the crop. An instinctive recognition of this principle has led cultivators of alkali soil in some cases to resort to sanding the surface, and with temporary good results.

But the mainstay in the cultivation of alkali land must always be the maintenance of deep and loose tilth throughout the times when evaporation is active. This implies the growing on them of hoed rather than grain crops, unless drill culture (which at present prices would hardly pay) were resorted to. The growing of corn, beans, beets, and possibly of cañaigre, always choosing preferably the deep-rooted crops, is therefore indicated, and experience at Chino has conclusively shown that the best of beets may be grown on light alkali soils in which common salt is not too prominent.

"Black" and "white" alkali.—Deep and loose tillage, however, is practically impossible on lands tainted with any considerable amount of "black" alkali. It will remain cloddy, and will crust over, even with dew, despite all cultivating, harrowing, and clod crushing. The first need is the neutralization of the black alkali with gypsum, by which operation other important benefits are also secured. The saving in cost of cultivation on heavier lands will alone soon pay for the purchase of the gypsum, aside from increased and improved products. It must always be remembered that little or no benefit is to be expected from it in cases of purely "white,"

neutral alkali; but there are tens of thousands of acres of alkali land now lying idle, lightly tainted with "black" alkali, that would be definitely reclaimed and rendered profusely productive by the use, once for all, of a ton of gypsum per acre. But it is not absolutely necessary to use the entire amount at once. It can also be done by annual installments of, say, 500 pounds per acre, put in some time before the seed. The latter will thus be protected from being killed by the black alkali and secure a stand to shade the ground, preventing an injurious rise of salts for the season at least. It must be remembered, however, that gypsum can not act on alkali without water; and that the action itself takes several weeks for completion before immunity is secured.

Senator BOYD. I understand the Doctor to say that the sugar beets have the vitality to reject the alkali. I would like to ask if other roots or vegetables have that power?

Mr. HILGARD. I do not know, sir.

The CHAIRMAN. The Chair names the following committee to consider the matter of uniformity in the nomenclature of station publications: Messrs. Armsby, Jenkins, Tracy, Hunt, and Gillette.

Morning session adjourned at 12.40 p. m.

EVENING SESSION, THURSDAY, JULY 18, 1895.

Convention called to order in "ordinary," Brown Palace Hotel, at 8.15 p. m., Chairman Henry E. Alvord presiding.

Mr. GOODELL. Mr. President, the executive committee offers the following resolution, and recommends its adoption:

Resolved, That the executive committee be authorized to call upon every institution eligible to membership in this Association for a contribution of $10 to defray the necessary expenses for the next year, the same to be payable as soon as practicable after the 1st of January, 1896.

Adopted.

Mr. GOODELL. The executive committee reports back without recommendation the resolution offered by Mr. Wheeler regarding the adoption of the metric system, as follows:

Resolved, That it is the sense of this Association that a great saving in the time required for the education of the people of the country might be made, and that the business of the country would be facilitated by the early adoption of the metric system as the only legal standard of weights and measures for the United States; and furthermore, that the country is now as well situated as it probably ever will be for the adoption of this system.

The CHAIRMAN. The convention hears the resolution offered by Mr. Wheeler reported back without recommendation. What is the pleasure of the convention?

Mr. MILLS. I move the resolution be not adopted.

Motion seconded, with the amendment that this resolution lie on the table.

Motion adopted as amended. Resolution laid on table.

Mr. GOODELL. The executive committee reports back in a modified form the resolution offered by Mr. Connell, regarding the appointment of a standing committee to report on methods of instructions abroad, as follows:

Resolved, That a standing committee of five be appointed, whose duty it shall be to report annually upon the best methods used in the various colleges of the world for the instruction of students in the practical and scientific facts relating to agriculture with a view to bringing instruction in agriculture into pedagogic form.

Adopted.

Mr. GOODELL. I am instructed by the executive committee to offer the following resolution:

Resolved, That the executive committee be authorized to edit and procure the publication of the proceedings of this convention in cooperation with the United States Department of Agriculture.

Adopted.

Mr. GOODELL. The executive committee, to which was referred the resolution of Mr. MacLean, touching the place of holding the next annual convention, refers the same to the incoming executive committee.

Resolved, That the convention request the executive committee to accept the cordial invitation extended by President Cyrus Northrop, of the University of Minnesota, to hold the next annual convention of the Association at Minneapolis.

After considerable discussion the reference of the resolution was adopted.

Mr. GOODELL. I am instructed by the committee on order of business to now offer an opportunity for the members of this convention to give expression of opinion as to the place of holding the next annual meeting.

Mr. ARMSBY. I wish to tender the Association a cordial invitation to hold the next annual convention in Pennsylvania.

Mr. MYERS. I desire to extend an invitation, upon the part of West Virginia, to the members of this Association to hold their next meeting in West Virginia.

Mr. BRYAN. I should like to invite the convention to meet in the West next year, and therefore extend the Association a cordial invitation to meet in the great State which bears the name of the "Father of his country."

Mr. HAYS. We did not want to establish the precedent of carrying such motions; we concluded that the precedent had been established last year, and we naturally felt entirely justified in bringing the matter up in the same way. This action of the convention does not in any way detract from the matter of coming from Minneapolis, so far as I see or feel, and I assure you that the invitation is just as hearty a one as President Northrop put it the other evening, and we hope and expect to see you at Minneapolis next year. You may see some of the lakes and some other things while there, and you will be treated nicely.

The CHAIRMAN. Are there any other remarks to be made as to the time and place of holding the next annual convention?

Mr. BOLLEY. I would like to say that North Dakota would be glad to see the convention meet at Minneapolis next year. We will treat you royally if you will take an excursion to the Red River Valley in North Dakota.

The CHAIRMAN. The resolution just passed by the convention, providing for a standing committee upon the subject of agricultural instruction, failed to state the number of the members of the committee.

Mr. CONNELL. I move that a committee of five be appointed by the chair.

Motion carried.

The CHAIRMAN. The committee will be appointed.

Mr. LAZENBY. The Section on Horticulture and Botany has nominated Messrs. F. W. Card, chairman, and H. L. Bolley, secretary, of the section for the ensuing year. The section also presents the following resolution:

Resolved, That the formation of the proposed section on irrigation is inexpedient and uncalled for.

The CHAIRMAN. It is moved and seconded that these nominations for officers of the Section on Horticulture and Botany be passed.

It is a vote, and the officers nominated for the ensuing year are elected.

Mr. CONNELL. Mr. President, at the afternoon session of the Section on College Work the following were selected as the officers of the section for the ensuing year: Chairman, A. A. Johnson; vice-chairman, J. E. Stubbs; secretary, E. Davenport.

Confirmed.

The CHAIRMAN. The resolution coming from the Section on Horticulture and Botany, relating to the formation of a section on irrigation, and reported back by the section as being inexpedient and uncalled for, is before the convention for its action. What is the pleasure of the convention?

Moved and seconded that this resolution be laid on the table.

Adopted. Resolution laid on table.

The CHAIRMAN. The next order of business is reports of committees.

Mr. Hays. The committee on indexing agricultural literature recommends the following:

Resolved, That the Department of Agriculture be requested by this Association to compile and publish a list of agricultural literature other than station publications, and that the feasibility of making and publishing a subject index of this literature be further investigated, and if found feasible that this also be made by the Department of Agriculture and published; and that a committee of three be appointed to confer with the Office of Experiment Stations and to urge the importance of this matter upon the Department of Agriculture.

The Chairman. The special committee of last year, appointed by this Association, for indexing agricultural literature, makes, through its chairman, this report, recommending the appointment of a special committee—as I understand it the appointment of another committee of three. What is the pleasure of the convention? This report, coming from a committee of the Association appointed last year, is in the hands of the convention for action.

Mr. Goodell. I would offer as a substitute the following:

Resolved, That a committee of three be appointed to confer with the Department of Agriculture with reference to the preparation and publication of a catalogue of literature for the use of teachers and students of agriculture, with power to arrange for the publication of such catalogue, if this is found to be practicable.

The Chairman. The question now is upon the substitute. What is the pleasure of the convention?

Mr. Hays. Mr. President, this substitute is entirely satisfactory to me. I have put a great deal of work upon this subject. We hope that we have nearly worked out a scheme that will make the subject index practicable. I have worked out about 3,000 cards, covering nearly all questions or subjects of interest included in agriculture. I have put about all the time into it that it was possible for me to give to it, and although I have met many difficulties, I feel that some of them have been overcome. No one else has suggested a plan for doing this kind of work.

Mr. Goodell. My object in offering this substitute is that we feel that this part of it can be carried; the second part does not seem to be feasible just at this time.

The Chairman. The question, then, is upon the substitute, which takes the place of the original resolution.

Resolution adopted.

The Chairman. The chair will appoint as this committee, with all due deference to the original committee, the chairman of the new executive committee, Prof. W. M. Hays, and the secretary of the Association (Dr. John H. Washburn).

Mr. Wells. I am directed to present the following resolutions prepared by the committee on courtesies extended to the convention:

Resolved, (1) That we express our appreciation of the full and accurate reports of the proceedings of the convention by the press of Denver.

(2) That we extend our thanks to the management of the Brown Palace Hotel for entertaining the convention so handsomely.

(3) That we acknowledge the many favors extended by the Chamber of Commerce and the citizens of Denver in general.

(4) That we acknowledge the efforts of President Johnson of Wyoming, President Ellis of Colorado, and the Western men in general, in making the convention such a success.

(5) That we express in advance our appreciation to President Ellis, the faculty, and trustees of State College of Colorado, for the trip to Fort Collins on Friday, July 19.

(6) That we recognize the efforts of the National Educational Association in securing cheap transportation that this Association was able to take advantage of.

(7) That we desire to express our appreciation of the valuable work of our retiring president, Major Alvord, in developing the interests of the Association.

Franklin Wells.
F. Paul Anderson.
G. E. MacLean.

The Chairman. Gentlemen, you have heard the resolutions offered by the committee on courtesies extended to this convention; what is your pleasure?

Resolutions adopted.

The CHAIRMAN. The next order of business, as I understand it, is a paper from the Section on Mechanic Arts, by Prof. L. C. Colburn, of Wyoming.

Mr. TRUE. Mr. Chairman, you will excuse my remarks at this time, but I merely wished to say that the Secretary of Agriculture has to-day called my attention to a matter which illustrates a class of questions which are continually arising in the Department and which relate to the propriety of the conduct of station officers. The particular question which has arisen at this time is as to whether it is proper for station officers to give out analyses or testimonials for advertising purposes? There seems to be in some cases a doubt in the minds of station officers as to whether they are really public officers or not, and therefore what seems to be an attempt on their part to act sometimes as public officials and sometimes as private individuals. I think we can all see that it is impossible for a station chemist, for example, to give out an analysis or testimonial as a private individual, and that he ought not to do so as a public officer; and the answer which the Department would have to make to such a question would be that it is an improper thing for the station officer to do this. I brought this matter up, however, especially that officers of stations might give thoughtful consideration to matters along this line, as I think they deserve some attention.

Mr. HAECKER. I would like to ask just one question upon this point, and it is a point that nearly all the officers of stations will be interested in: Would it be proper for a member of a station staff to indorse a certain machine—to say that it does good work in the station? As I understand it, we are public officers; and a committee comes to me (as has been the case not less than forty times since the beginning of this year) and they say, "What separator do you use in your station creamery, and would you recommend that we buy that kind?"

Mr. TRUE. Well, in such a case as that, I think it is hardly wise for the station to recommend any particular piece of machinery which is a patented article. It seems to me the best way would be for the station officer to describe to that committee the qualities of a good separator and let them decide the rest.

Mr. HAECKER. We have found that there is only a certain kind of a separator that will do satisfactory work and the others will waste more cream than they are worth.

The CHAIRMAN. I have already started on the programme of the evening, the first paper being that of Prof. L. C. Colburn, of Wyoming, entitled "The Theoretical *v.* Practical Work of an Engineering Course."

I should like very much to invite the members of the Association to discuss this paper, but we have three other papers to be presented. As I hear no objection from the members we will pass to the next topic, which is "Some Undefined Duties and Methods of Station Horticulturists," by F. W. Rane, of West Virginia.

SOME UNDEFINED DUTIES AND METHODS OF STATION HORTICULTURISTS.

The general duties of the station horticulturist are familiar to us all, and I doubt not that every worker knows his particular field. In some lines of work and investigation, however, his duties do not seem to be clearly defined, which fact is evident from the various treatment of these questions by our horticulturists. Doubtless similar problems have been discussed and solved at previous meetings, but as the occupation is a progressive one, and conditions are different, owing to the formation of new departments and the changing about of horticulturists, perhaps at this time it would be well to reconsider some questions of interest.

While the stations form a great network throughout the United States and Canada, each one is necessarily solving its own individual needs. As far as I am able to judge, every station horticulturist has his own methods and solutions. While this is perhaps necessary in many cases of local interest or value, yet there are many questions of equal importance and of common interest.

The past year I desired to do something in the way of testing garden vegetables and fruits. As horticultural work is new in West Virginia, and realizing that many station horticulturists differ in their estimation of the value of such work, I concluded to obtain an expression from each of the stations. (Many present doubtless remember receiving this request.) Possibly the questions asked were not sufficiently clear, but at any rate the replies were very discordant, ranging from unimportant and unsatisfactory to those of unquestionable value. At first reading it seemed as though no two horticulturists were of the same opinion, but further consideration revealed several somewhat similar expressions. It did not seem to be clear as to what should be considered a variety test. Such answers as these came: "We endeavor to get everything new and grow them, so as to know something about them should inquiries demand such knowledge, but we do not attempt to test varieties." This, it appears to me, is nothing more than a testing of varieties. It may be necessary, when testing for the first time, to select all the older and more common varieties in use, together with the introductions of that year, using the former as a basis for comparison. After this is once done, it seems to me that it is necessary to test simply to determine the value of later introductions.

Variety testing is done yearly at most of the stations, at least to the extent of the new introductions. One horticulturist expressed himself thus: "The work must be constantly maintained, but is really the trifling incident of hard horticultural work." Still others:

"(1) I do as little as possible and use only those I think worthy."

"(2) We make no attempt to test novelties. We get in all the varieties we can of any subject which we take up for serious study, but we never make any miscellaneous tests of anything simply because they are new."

"(3) We endeavor to get all of the latest and best things in one way or another."

"(4) I select varieties always with this thought when reading the description: Suppose it is true; of what account would it be to my State?"

"(5) I have about come to the conclusion that it is best to look with suspicion upon all new introductions unless they are brought to the notice of the public through some of the regular channels, and accompanied by statements of disinterested horticulturists who are recognized as authorities."

"(6) I am devoting less and less time to variety tests each year. Let us reverse the engine and originate new varieties for others to test, instead of exerting our energies in hunting up the things that nonprofessional horticulturists are developing for us."

"(7) I think that if the greatest part of the work that has been done in the way of variety testing had been left undone, we would have been just as well off, and a vast amount of work saved for more important things."

I might give extracts from others, but I think that these give a fair idea of the diversity of opinion. It seems to be the prevailing opinion that the testing of varieties demands the consideration of the horticulturist, although some few believe it of little value. This having been settled, several other questions naturally arise, which I state here to provoke discussion:

(1) Where should we get the specimens for testing? Should we not be governed by some definite rule? Is it advisable to test seeds or plants which come from other sources than the originator or introducer?

(2) Should we not have a definite understanding with seedsmen or nurserymen? At present seeds are sent for trial purposes to the various stations, many of which are totally worthless for the purpose. They are often flower seeds, which many stations do not bother with, or seeds that have arrived so late that they can not be used that season; or again, some varieties are not adapted to the section or State to which they are sent. Why would it not be a good idea for each horticulturist to have a standing list stating just what seeds or plants are desired, and no others; also giving the dates when the seeds must be received in order to include them in that year's test? By this means a great deal of the misunderstanding and unpleasantness that arises at present would be overcome.

(3) Is it ever our place to recognize unknown introducers? I have done this in our own State, but it is questionable whether even this should be allowed, much less recognizing those from other States, unless they be recommended by members of the county or State horticultural societies. One writer says: "An unknown man may have as valuable and rare a variety as a prominent firm." While this may be true, it seems to me that if these valuable and rare varieties are thought to be worthy of a test on the part of the stations, the introducer could very easily obtain recommendation from the members of the horticultural societies. By this means we would be freed from undesirable tests, and, too, the societies' effectiveness would be increased. The past year numerous pamphlets from various States have come to me claiming great things for certain new varieties, and asking a correspondingly high price; for instance, strawberries at $3 per dozen, and potatoes at 50 cents per pound. Not knowing the introducers, what am I to do in such a case? One station worker says: "Purchase those thought to have merit, also all humbugs." Which case do the above examples come under? Another horticulturist says: "I request them for trial, and if upon a request its donation is refused, we purchase it, if not too costly. If too much is asked, we simply do without, arguing that its test would not be of practical benefit to the public until its cost was reduced to a reasonable figure." In considering

this the question naturally arises, What should be donated and what purchased? One station horticulturist says: "On the whole, those sent in are an evidence of some value," while another in almost an adjoining State says: "Those things which want testing are seldom donated." Still others claim they find it best to always purchase, that they may have the right of disseminating. Thus, again, it is a perplexing question. It seems as if legislation of an interstate nature were needed. An unknown man or firm, not backed by his State horticultural society or the horticulturist of his State experiment station, should not be allowed to ask high prices for novelties in other States. It appears to me that when we, as station horticulturists, purchase of such dealers we are aiding frauds. Anyone could print a very neat 2-leaf folder, claiming everything for a certain variety, as, for example, strawberries at $3 per dozen. Those possibly purchased by the stations would pay for his expense in printing, while the sales to amateurs and enthusiasts would probably realize him a neat sum. Even should the stations expose him as a fraud, what difference would it make after he had worked his scheme? Does it not look reasonable that if a man or firm is desirous of placing a novelty on the market on its merits, it is for his advantage to be assisted by the experiment stations? On the other hand, would we not be anxious that the people of our State derive all benefit from worthy introductions? Therefore, it seems as though it should be required that specimens of novelties be sent to the stations for trial, or that the horticulturists of the introducer's State be requested to visit him. One of our Canadian brothers says: "Introducers should send products free of charge, and growers should be taught not to purchase until tested."

(4) When should we eliminate the test of various flowers, fruits, and vegetables? One station worker says: "Never carry on tests for years as a museum; two reports are sufficient." Another says: "Discard only those not worthy after tests, and retain others after two years."

(5) How many plants should be considered a fair test? This question, it seems to me, needs a solution. By examining our bulletins, one easily sees there is no uniformity; for example, at the West Virginia station we have considered ten plants of each variety of tomatoes a fair test, while other stations range from five to twenty-five plants. We usually take twenty-five plants when testing the brassicas, twelve of strawberries, six of raspberries and blackberries, and from two to three for currants, gooseberries, etc. Each station, as far as I know, has its own methods; but ought we not to have a standard number?

(6) Do plants under test need spraying for both fungus diseases and insects? One naturally would think this necessary, but in many States spraying is comparatively new, and the results are misleading to those who do not employ them. It seems necessary to me, provided we are to show the possibilities of varieties.

(7) What is the station horticulturist's place in disseminating plants? Does our duty cease when we have proved the merit of certain varieties and have published, say, two reports upon them, stating where they may be obtained; or is it permissible for us to disseminate them ourselves, either donating or selling them? There, perhaps, would be no question as to the disposition of our own original varieties, but in case they are already on the market at reasonable prices, what should our alternative be?

(8) Is it advisable to give reports of tests to individuals or firms in any way other than through published bulletins? One station horticulturist says: "I never under any circumstances report to him (the donator) individually."

Many other questions might be presented in this paper, but these few are perhaps sufficient for the present. They have confronted me in my work, as I venture to say they have others. We as horticulturists should meet yearly to combine our efforts toward the solution of the best ways and means of handling the different phases of our work. Last year was the first time I ever attended this Association, and that meeting proved of value in many ways. We can well afford, it seems to me, to hand over subjects of a technical nature to our more purely scientific societies and in this meeting discuss those questions of general and practical value.

The Chairman. We are approaching so near the hour of adjournment, I think I will have to announce the paper on "Cheese-Curd Inflation: Its Relation to the Bacterial Flora of Foremilk," by H. L. Bolley, of North Dakota.

CHEESE-CURD INFLATION: ITS RELATION TO THE BACTERIAL FLORA OF FOREMILK.[1]

It is at this time scarcely necessary to make mention of the varied effects, beneficial and detrimental, induced by the bacteria and fungi upon a cheese product during its different stages of manufacture. In general, these effects are recognized as being of economic importance but a few years since scarcely imaginable. Aside from its body substance of casein and fat, cheese, it is well understood, owes its value to fermentations and decompositions occasioned by microorganisms, and the product, as to kinds produced, has been fixed through methods based upon biological conditions now known to have been necessary.

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[1] Preliminary investigations and direction of the work by H. L. Bolley; final cultural tests upon foremilk by C. M. Hall.

To date, the flora of cheese manufacture has been essentially accidental, except, perhaps, it be admitted as otherwise in the establishment of certain biological conditions which must obtain in the proper making of special types, such as Emmenthaler and Roquefort. Pure-culture cheeses are as yet matters of experimentation.[1] Fermentations and decompositions are thus accidental, and with the possible exception of a few which are pronouncedly efficacious in good or evil effects, one can not be certain as to the valuation to be placed upon individual results.

Of these modifications and changes, gas formation in the curd during its manipulation and subsequent ripening is peculiarly active and worthy of close investigation. Certain it is that in the factory it is an efficacious originator of troubles. However, it may not be said that Emmenthaler would have its present value without the holes (Lochern). But gas formation in cheese is not specific,[2] i. e., due to the action of a specific organism; hence one may properly, as has been indicated by Adametz,[3] group these gas generators into normal and abnormal cheese types, i. e., good and evil originating forms. It is also possible that some of these, while troublesome in the time of the curd manipulation, may be found of extreme value in the sum total of the cheese process. If so, it becomes but the more certain a matter of scientific factory processes, based upon studies into methods of control. At best, it may be said that there are some types of gas formation which, under present methods, are very detrimental and costly in effects occasioned, the active curd conditions being variously designated as "Käseblähung,"[4] "Le boursouflement des Fromages,"[5] "Lochbildung und Blähung der Käse,"[6] "floating curd," and "pin-hole curd formation."[7] Adametz[8] has estimated that the Swiss manufacturers of Emmenthaler alone sacrificed annually millions of francs to these curd troubles. To appreciate these losses, one has but to visit manufactories of hard cheese in this country, observing similar troubles resulting in "floating curds," cheese inflation during the green period, and often ripened, distorted, and tainted final products.

Through the kindness of Dr. H. L. Russell and of Director Henry, of the University of Wisconsin Experiment Station, I was enabled during the months of July and August of 1894 to aid in some investigations of these matters under the bountiful facilities of laboratories, dairy, and factory there afforded.[9]

Cheese curd inflation, a biologial phenomenon.—Though as early as 1890, Weigmann[10] and Freudenreich[11] had called attention to the fact that they had discovered a few individual species of pathogenic bacteria which by attacking the milk sugar gave rise to gas formation, which results in "Blähung der Käse," their conclusions had not been accepted as general. Indeed, even yet, some of our chemists may have a lurking suspicion that the origin of "pin-hole" formation has its inception in peculiarities inherent in the milk, and that the trouble may be incident to the methods of curd manipulation. Experienced cheese makers have quite generally affirmed that its chief origin is "dirty milk." The work upon which this paper is based reaffirms this belief. In the factories curd inflation seems everywhere general. It is only a matter of degree from curds but slightly if at all injured by the presence of minute, evenly distributed gas openings, to types quite troublesome to valueless because of toughened, tainted, inflated, and distorted conditions.

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[1] Upon these points see general literature of the subject by Adametz, Baumann, Duclaux, Freudenreich, Weigmann, and others.

[2] This is substantiated by these investigations. Also see Adametz résumé, "Ueber die Ursachen und die Erreger die Abnormalen Reifungsvorgänge beim Käse. Das 'Blähen' oder 'Gären' der Käse," Milch Ztg., 1893, Nos. 12, 14, and 15.

[3] Loc. cit.

[4] Adametz, loc. cit.

[5] Freudenreich, Ann. Micr., 1890, p. 553; cited from Koch's Jähresber. Gährungs-Org., 1890, p. 95.

[6] Weigmann, Landw. Wochenbl. Schles. Holst., 1890, No. 37.

[7] Russell, Outlines of Dairy Bacteriology, pp. 39–41.

[8] Milch Ztg., 1893, No. 12, p. 187.

[9] Assisting Dr. Russell, the facts accumulated there belong rightfully within his publication of continuous investigations. My thanks are here due to his guidance and introduction to this interesting field of work. I hope, however, at this time, to use only such parts of the work as directly connects with the later works of Mr. Hall and myself.

[10] Ueber die Lochbildung und Blähung der Käse (Milch Ztg., 1890, p. 741).

[11] "Ueber einen neuen im geblähen Käse gefundenen Bacillus (Bacillus Schafferi)." Landw. Jahrb. Schweiz, 1890, p. 17; and "Sur quelques bacteries produisant le boursouflement des fromages" (Ann. Micr., 1890, p. 553. Cited from Koch's Jahresber. Gährungs-Org., 1890, p. 95).

General facts suggestive of a biological origin of the trouble may be given as follows: (1) It is certain to occur in milk known to contain much dust and dirt of a stable type; (2) It is most damaging in results from over-ripened milk; (3) aeration of milk is beneficial, and may at times even prevent its occurrence; (4) the conditions of curd manipulation are particularly favorable to bacterial growth, and the evolution of gas is always most rapid as the temperature approaches the optimum for such growth; (5) heavy growths of bacteria always line the cavities of curd and cheese holes; (6) the same sample of milk always gives "pin-hole" formations.

These points are self-explanatory, except perhaps that of aeration. To this it may be suggested that most gas-evolving types are markedly lovers of conditions approaching those of complete or semi-anaerobiosis.[1]

Working upon the assumption of a biological origin of the troubles, numerous experiments, the details of which do not properly fall within the province of this article but which were inclusive of bacteriological exclusiveness, demonstrated that solid curds could be made from the worst types of "pin-hole" forming milk, provided the original bacterial flora was eliminated. Perhaps the best proof of the biological nature, aside from the results just given, rests in the fact that when antiseptic methods were resorted to "pin-hole" formation was checked in direct proportion to the value of the bactericide used.[2]

Having thus become satisfied as to the cause, and that rapid tests of individual samples of milk were possible, the economic question of germ sources was open to consideration, and the important results bearing upon the exclusion of milk furnished by untidy patrons came into view. It was found that such tests could be made and were reliable for an individual sample, but here there is a halt. Creameries and factories and accessories thereto are found to be generally infested by miscellaneous microorganisms, and the gas generating types are no exception.

While at Madison I separated and have made careful cultural studies of six distinct forms of the latter from one vat of mixed milk—one oospera-like fungus, three bacillus, and two micrococcus types. All of these were quite constantly present in the factory, and at different times were taken from different locations, as from separator slime, milk in the vats, separated milk, milk from the cows of special patrons, from the whey in the gas cavities of green curds, and one, a spore from No. 36*c*, from pasteurized cream.[3]

We may thus, in consideration of these facts, together with the notations of the comparatively large number of separate species described by the European workers Weigmann[4], Adametz[5], Freudenreich[6], McFadyean[7], and Baumann[6] as being capable of curd inflation, assume that these troubles are generally distributed and due to a miscellaneous number of specifically different organisms.

The foremilk as a possible source of factory infection.—Knowledge of the sources of these troublesome organisms thus becomes of first importance. Aside from actual filth, the foremilk has been shown to be a source of abundant bacterial infection. As has been stated by Russell[8] under conditions of cleanliness in milking, this is probably the predominant source of germ content. Lehmann[9] estimated for first milk drawn 50,000 to 100,000 per cubic centimeter, and Schults[10] found a content ranging in separate tests from 55,566 to 99,600 per cubic centimeter. If, then, it be found that the normal udder is but a well-regulated incubator for such organisms, relief seems somewhat more distant than common cleanliness in the stable.

The following points are given as indicating that the foremilk is not above suspicion: (1) Germs are always present in the first milk drawn. (2) Gas-forming types heretofore studied are of such nature as to be associated with stable filth. Adametz[11] has also listed sixteen similar organisms, including yeasts and bacteria of general decomposition. (3) Under stable conditions there are also apt to be forms capable of growth at the body temperature. Of such Adametz's résumé lists ten species of pathogens shown to be capable of "Käse Blähung," by various investigators. These include such forms as *Bacillus coli commune*, Escherisch, and the various urine-loving micrococci. (4) The milk-moistened openings of the teats come easily and often in contact with such germ-bearing matters of the stable and animal body. (5) Gas-producing bacteria seem inclined to anærobiosis, and it seems possible that conditions approaching these demands exist in the normal udder. (6) Contrary, also, to the considerations of Adametz,[1] I find that some forms, markedly of the lactic-acid type, may be capable of heavy curd inflations.

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[1] This is substantiated by the characteristics of the species here studied. See also Fraenkel Text-book of Bacteriologie, Eng. ed., pp. 24, 115, 217, 222, and 334. Also Beyerinck "Zur Ernährungsphysiologie des Kahmpilzes," Centbl. Bakt. und Par., 11, p. 68. Pasteur (Studies on Fermentation, Faulkners' Eng. ed., p. 269).

[2] This work has been duplicated at Fargo; and I am also informed by Dr. Russell that the results of the same type of work carried into tests upon full-sized cheeses, made at Madison at the time of the above-described tests, have confirmed the more limited trial tests.

[3] These organisms will receive special consideration in a following paper.

[4] Russell, Outlines of Dairy Bacteriology.

[5] Milch Ztg., 1893, Nos. 12, 14, and 15.

[6] Landw. Vers. Stat., 42, p. 214.

[7] Landw. Jahrb. Schweiz, 1890, p. 64.

[8] Outlines of Dairy Bacteriology, 1894, p. 40.

[9] Cited from Grotenfelt, Principles of Modern Dairy Practice. Woll's Eng. Ed., p. 24.

[10] Ueber den Schmutzgehalt der Würzburger Marktmilch u. die Herkunft der Milch Bacterien, Arch. Hyg., 14, p. 260; cited from Koch's Jahresber. Gährungs-Org., 1892, p. 176.

[11] Milch Ztg., 1893, No. 15, p. 240.

Under these considerations it seems that foremilk might be concerned in cheese-curd inflation from a broader basis of kinds than that represented by infections due only to such disease-producing types as *Bacillus guillebeau* of Freudenreich[2] or *Bacillus lactis ærogenes* and *Micrococcus mastitis* of Adametz.[3]

Gross tests of foremilk, preliminary cheese curd, and fermentation tube tests.—This study was made upon two cows at Madison, Wis. At the time, August 28, the animals were under the continuous pasture conditions, and were, bodily, very cleanly. The cheese-curd tests were each made under same conditions after allowing the milk to stand for twelve hours at 18° C. The fermentation tube tests were made by infecting same with one thirtieth cubic centimeter of the milk immediately following the milk taking.

Test No. 1. Full milk of Shorthorn cow, used, bottled, direct from sterile milking pail, without other precautions than exclusion of the foremilk. Result: Heavy gas inflation, curd, a leathery "floater;" in the fermentation tube heavy gas formation, culture practically exhausted in the first twelve hours.

Test No. 2. Strippings from Shorthorn cow taken with following precautions: Flank, belly, and udder of animal washed and dried with moist cloth, and the hands of the milker likewise treated; the milk stripped direct into a sterile bottle. Results: A very few large "pin holes" in a solid nonfloating curd; no gas formation in fermentation tube after forty-eight hours.

Test No. 3. Foremilk from all the teats of a Jersey cow "Bessie." All precautions observed as in No. 2. Results as in No. 2.

Test No. 4. Strippings from "Bessie." All precautions observed. Results as in last. A solid curd with a few "pin holes;" fermentation test, slight evolutions of gas began after twenty-four hours.

Test No. 5. Foremilk from Shorthorn cow; no special precautions, save only that the milk was drawn direct into a sterile bottle in such manner that but slight dirt might fall into the neck of the bottle. Results: A good curd like that of 2, 3, and 4. The fermentation test gave a slow evolution of gas after twenty-four hours.

This work was duplicated October 10, at Fargo, upon two cows with essentially like results, the general full milk at the time giving a bad type of floating curd. The evidence from these tests is that the gas-originating organisms were not located in the udders either in the fore or last milk, and that the few "pin holes" or curds 2, 3, 4, and 5 must have had an external origin. This is made more evident by the results from the general milk of No. 1, though it was taken under conditions of more than ordinary neatness.

Qualitative determination of the bacterial flora in the normal udder.[4]—To the above described results a qualitative investigation must give much added work. To this end, such facts of Mr. Hall's studies as bear directly upon the question are here given.

The examinations were made upon 10 healthy cows living under cleanly stable conditions during the period between the dates of January 22 and April 25. The method was kept uniform, 20 cubic centimeters each of fore and last milk were drawn from same single teat and subjected to Petri plate culture analysis upon neutral gelatin at room temperature. The milk was always drawn through a sterile silver milk tube into a sterile narrow-necked ounce bottle. The milk tube was always extended completely into the milk cistern, after first excluding 1 to 2 drops of milk. Results:

(1) From 30 different examinations of fore and hind milk made upon 9 different dates, 16 distinct species of bacteria were isolated. (*a*) Of these, 5 were found only in foremilk, 4 of them occurring only once each in separate samples. (*b*) Six occurred only once each in separate samples of last drawn. (*c*) Five were found common to both fore and last milk. (*d*) One of the last-named lot, No. 30, was found common to the fore and last drawn milk of 5 different cows upon 5 different

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[1] Milch Ztg., 1893, No. 12, p. 188.

[2] Ann. Micr., 1890, p. 56.

[3] Milch. Ztg., 1893, No. 15, pp. 237, 238.

[4] Work done by Mr. Hall, senior student at the Agricultural College, Fargo, N. Dak. In so far as I am aware this is essentially new work.

dates. (*e*) Species No. 20 was twice found in the foremilk of cow No. 27, dates January 22 and January 29. No. 28 occurred in the last milk of cow No. 25, January 23, and in her foremilk on date of April 25. No. 84 was found in the foremilk of cow No. 24 February 15, and again common to fore and hind milk April 25. No. 72 occurred in foremilk of cow No. 20, and was also common to fore and last milk of cow No. 21 upon date of March 9. No. 30, the most common species, occurred in udder of cow No. 25 upon January 22 and April 25. In the case of cow No. 27 it was present on dates of January 22 and January 29.[1]

(2) Five species, Nos. 20, 23, 25, 28, and 65, are gelatin liquifiers; eleven are solid forms.

(3) Seven species are facultative anærobes; nine seem to prefer ærobic conditions.

(4) Three species, 66, 83, and 75, fail to vegetate at a constant temperature of 35° C.; thirteen develop rapidly at that temperature.

(5) Twelve species produce an acid reaction in milk, three are alkaline curdlers, and one, No. 30, leaves milk apparently unchanged.

(6) Twelve are actively motile, four nonmotile.

(7) Only two samples of sterile milk were drawn, one from cow No. 24, April 15, and one from cow No. 26, April 19, but samples of last milk containing only No. 30 remained unchanged.

(8) The greatest number of species present in one examination was four, most often two, but at times only one.

(9) Only bacteria were ever found.

(10) No gas-engendering organisms were found.

This work is perhaps too limited in the number of cows investigated, and the number of duplicate cultures made from same animals to assert any conclusions as to constancy of species, or of physiological types present in fore milk. The work, however, is given as a preliminary study, and may be said to indicate (1) no bacterial flora common to the animals investigated, save one peculiar nonmilk-affecting species, No. 30; (2) that a given form, when once present, may be quite constant in its occupancy of the udder of an individual animal.

Finally, the absence of gas-producing organisms remain unexplained, but adds significance to the previously described curd tests. It may yet be found that these results may not hold good even at Fargo, for it is a possibility, though I think hardly probable, that during the period covered by Mr. Hall's investigations, the months of January, February, March, and April, the stables may have been free of gas-generating organisms. They were there, however, by my own observation during the months of October and November, as per the evidence of cheese-curd tests made from full mixed milk.

If later and scattered investigations confirm this absence of gas-producing organisms in normal foremilk, the economic importance of the matter becomes self-evident.

The CHAIRMAN. We still have a small amount of business to transact. The Chair has yet to announce two committees under the orders of the convention: First, the standing committee of five to report on new methods of agricultural teaching—Messrs. J. H. Connell, A. C. True, T. F. Hunt, H. T. French, and L. B. Wing. There is also a special committee of three on the codification of the resolutions and important acts of the Association in previous years. As this committee I will appoint Messrs. H. H. Goodell, A. C. True, and, by order of the convention, the retiring president, Henry E. Alvord, is also a member of that committee.

Mr. COMSTOCK. I now move that this convention adjourn, subject to the action of the executive committee of this Association.

The CHAIRMAN. The Chair wishes to congratulate the Association upon the success of this convention. It is not a state secret that the executive committee felt some embarrassment from the fact that they were directed to recommend this city as the place of meeting this year and that the meeting was to be held at this season of the year, but nobody seems now to have any cause for regret. We have had, I think, a convention as largely representative, perhaps with one exception, as any heretofore held by the Association, and although not quite as largely attended by regular delegates numerically, yet I think you will all agree that this has been in many respects our most successful meeting. I think we have done more solid work, and work of a higher grade, than at any previous meeting. I think we may resolve ourselves for a moment into a mutual admiration society. Those in favor of adjourning sine die say "aye." Those opposed, "no."

The convention is adjourned sine die.

(Final adjournment had at 9.50 p. m.)

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[1] Cows No. 24, 25, and 27 are the only ones upon which tests were made upon different dates.

THE SECTION ON AGRICULTURE AND CHEMISTRY.

The section was called to order July 16, 1895, at 2 p. m., by Chairman E. B. Voorhees.

The question of the formation of a section on irrigation was raised, and after brief discussion it was moved that the subject of irrigation be discussed by this section, and thus, if possible, obviate the necessity for the formation of a separate section on irrigation.

It was then moved that the discussion on irrigation be set for the 17th.

The first paper was presented by W. C. Latta, as follows:

FORM, SIZE, ARRANGEMENT, AND TREATMENT OF PLATS IN FIELD EXPERIMENTATION.

There is a tendency to undervalue the results of field experiments. That there are difficulties to be met and overcome in this method of experimentation is freely admitted. The importance of such work, however, as an indication of what may be expected in farm practice should lead field experimenters to carefully scrutinize their methods, in order to eliminate as far as possible the various sources of error in such work.

Assuming, at the outset, that the soil and climate in which a field experiment is to be performed are fairly representative of the locality, it is the purpose of the writer to very briefly suggest the form, size, arrangement, and treatment of plats that will conduce to accuracy of results. The views herein expressed are not given as final conclusions, but are held tentatively subject to revision upon receiving new light. It is hoped, therefore, that there may be a full discussion on the questions involved, in order that settled and well-defined conclusions may be formulated for the guidance of workers in field experimentation.

Form.—In form it is desirable that the field plats should be long and narrow, lying side by side, in actual contact with each other or with interspaces between plats, which should be cropped the same as the plats. In width the plats need not exceed 1 rod. Long, narrow plats can be brought near together and thus reduce largely the variation in the character of soil from plat to plat. The writer has found plats 14⅔ feet wide by 297 feet long and containing one-tenth acre very satisfactory. He has also employed spaces between plats one-half the width and the same length of the plats proper. These spaces are essential in tests of fertilizers, as they not only demonstrate the fact of diffusion of fertilizers or cross feeding, but they also measure the amount of the same by the increased yield of the crop produced thereon.

Size.—If it is the purpose of the experimenter to secure a result indicative of the returns per acre which may be secured in farm practice, the plats should seldom be less than one-twentieth of an acre in area, and one-tenth-acre plats would be better as a rule. The unavoidable errors in plat work would not be so greatly multiplied if the plats were even larger, say one-fourth acre each; but in the latter case the series of plats would probably be too extended for uniform treatment in point of time. It therefore seems desirable that the individual plats of the series should be not less than one-twentieth and not more than one-tenth acre in size as a general rule.

Arrangement.—The plats should be arranged in series so that a reliable average of treated and untreated plats may be obtained. For example: Let Nos. 1, 4, 7, 10, etc., of a series of plats be without special treatment for comparison with Nos. 2, 3, 5, 6, 8, 9, etc., which may receive the desired treatment. Better still, let each alternate plat be without treatment for comparison with intervening treated plats. The number of plats in a series should be limited only by the ability of the experimenter to subject the series to uniform treatment in point of time. That is, it would be very unwise to so extend a series of plats as to make it impossible to cultivate the entire series within one day. It is believed, however, that a series of ten plats for the investigation of a particular subject will, in most cases, be quite sufficient. It is desirable, and the writer considers it essential, to have all the plats of a given series entirely inclosed by a border along sides and ends of plats and intercropped the same as the plats.

Treatment.—It is essential that the several plats of any series should receive treatment uniform in all respects except the one under investigation. In order that this may be, the crop grown at any time should be the same on plats, spaces, and borders. This will give like exposure and environment to the several plats of the series. With uniformity in the cropping, the plats may be plowed at the same time. The plowing should be across the plats so as to subject equally all the plats and spaces to the influence of dead furrows and back furrows and leave all the plats of the series in an equal stage of preparation at any given time. In harrowing, the team should, as a rule, go the long way of the plats. This seems especially important in case any of the plats have been previously fertilized, in which case cross harrowing would tend to the diffusion of the fertilizers on to the unfertilized plats or intervening spaces.

In order to have exactly the same amount of seed on the several plats of a series, hand sowing or planting would be necessary, but this is so great a departure from the present methods of farming that it seems better to employ the usual farm machinery for putting in the crops. Care should be taken that the same number of rows and hills—in case the seed is disposed in hills—be placed in each plat. The width of the plats should previously have been calculated for the purpose of securing an equal number of rows in each plat. In the case of small grains a single hoe of the drill may be closed at the edges of the plats so as to permit the separate harvesting of the plats by the self-binder, mower, or other harvesting machine. Before harvesting the crop, all vacancies in the stand should be counted, or determined by accurate measurement, in order that the yield may later be reduced to a perfect stand. This may seem unwise, as in farm practice a perfect stand is seldom, if ever, obtained. It is believed, however, that the liability to inaccuracy of results will be reduced by this method of procedure. If, for any reason, the gradual harvesting of the crop should be necessary in order that partial curing may take place, the work should proceed across the plats so that equal portions of the same will be harvested at the close of any day. In gathering the crop—especially if it be corn—it is highly important that this rule be observed, as the corn fodder is quite subject to variation in weight, owing to changes in condition of atmosphere.

What has been said is but a mere outline of the subject and must prove highly unsatisfactory, but the writer does not feel justified in going further into details, as an extended discussion, without charts and verbal explanations, could hardly prove interesting or profitable to those present.

W. M. Hays read the following paper:

METHODS OF PLAT EXPERIMENTING.

Many things have conspired to discredit field experimenting. This class ot research is so environed by changeable climatic conditions, varying soils, the irregular attacks of insects, and the greater or less activity of microorganisms in the soil and plants that we can not control conditions, even when supplied with expert assistants and trained laborers. Our averages must be made up of a larger amount of data than in most other classes of research. The great expense of this line of work, when properly done, and the unsatisfactory results when we too hastily make conclusions have kept it from reaching that degree of respect among scientific workers, or among farmers, that it should have reached. The classes of research which most closely deal with the everyday routine of the farmer's business and home life are latest to receive their merited attention, because most difficult, and the most truly scientific work and great expense are necessary for their proper solution. We would not undertake them if it were not for the large material interests at stake in the raising of all our general agricultural crops and the large amount of labor employed, too often poorly directed.

Lawes and Gilbert, with wonderful patience, have devoted a goodly portion of their time for more than half a century to questions of field management, yet in this country we have had few who were ready to take up those questions relating to field management aside from fertilizer questions, which require for their solution a few or many decades of work on the same plats of land. The farmers of the Mississippi Valley, as well as of other sections, have been slow in studying field management, and the station workers there have a great opportunity to inaugurate new methods of rotations and new methods of cultivation and handling crops, and to tell which of the old ways of farming pay best.

We need to look upon the field as one unit, the acre unit, with which to deal; the class of crop, as the acre of corn or wheat; and the variety, as Fife or Blue-stem wheat, as another unit. We need to study the business questions, as well as the philosophies or theories.

Facilities for plat experimenting are too often meager or poor in quality. The most important is land of the desired richness and geological formation, and uniform, so that series of uniform plats may be laid out. Our Minnesota legislature is providing us with funds to procure lands in the distinctive parts of the State where field work suited to the respective soil and climatic conditions may be prosecuted. I am well pleased with the plan of dividing each field up into series or subfields, 8 rods wide, with rod-wide alleys between on which even a reaper may be turned. These series are subdivided by narrow cross alleys into plats 8 rods long by 1, 2, or 4 rods wide, thus making plats of one-twentieth, one-tenth, or one-fifth acre. Fields are designated by capital letters; south and east lines are in all cases used as base or initial number lines, and the series of plats are numbered from these with Roman numerals, while the plats are numbered from the base lines with Arabic numerals and subplats with small letters. We thus have a handy system for our crop records, and it gives us a history of the treatment of each smallest subdivision of the series and plats for each year. We try to have only one kind of crop growing on each series and to disturb the uniformity of each series as little as possible by different ways of treating each crop. We compost our manures by daily mixing together the product of all our barns in the same load, pile it systematically in long, flat piles, and when composted we take off loads in slices along the sides of the heap. These loads are then spread in narrow strips lengthwise on the series, thus crossing each plat with the manure from several loads, that each part may receive a similar amount of the fertility. We need a manure spreader for this purpose.

Laborers trained to do the field work are a necessity. It is a business learned only after years of practice. I would far prefer to leave the planting of our rotation experiments to our good German teamster, who has had several years' experience, than to myself, or even to my foreman alone. He may need the foreman or myself to help and watch him, but we make that his business and he becomes expert. He does not forget to properly adjust his seeder with each change to a different crop or plat. We must learn to better recognize and remunerate this kind of skill. We must change until we get good men and then treat them well, so that they will not only continue, but improve in efficiency from year to year.

An abundance of the most suitable machinery should be provided. We have a large number of small grain plats in our experiments, with varieties, rotations, and tillage experiments. We have reduced the annual expense so that now the actual labor on a one-tenth acre plat of small cereals is only one dollar and a quarter, while a few years since it was two or three times that amount, and very unsatisfactory as to the method, much of the work then being done by hand. We sow most of these crops with chain or press shoe drill. We clean the cups of the seeder box out with air, driven through a 1-inch rubber hose by the lungs or by a small bellows. To get the amount of seed sown on each plat, we fill the cups in the bottom of the seeder box, strike with a straightedge, and weigh the other seed put in the box, and with a straightedge again strike the grain off at the top of the cups, and weigh that taken out and subtract for the difference, or that actually planted. We have a drill half a rod wide, machine widths, making convenient fractional acres; stopping cups and using partitions, we sometimes make plats only several drills wide, with 12 to 16 inch alleys between. We harvest these plats, which are at least a foot apart, for the grain board to separate them, with a self-binder, a helper being always on hand to take off any incomplete bundles when finishing the plat, and to gather up any scattering grain left on the machine, and at once to shock on the plat every bundle cut from it.

We thrash as soon as possible from the shock, after each class of crop is dry enough. We have had a 28-inch thrashing machine made to order, in which all shelves are made slanting, all elevators and spouts self-cleaning, and in which hardly one ounce of grain remains between plats. We thrashed out 111 plats in one day, simply turning the governor on the engine so as to run the separator at a third greater speed for one or two minutes between plats. Each wagon takes from the plats to the thrashing machine, crossing the wagon scales to get the weight of the bundles, one or two plats of bundles, and by subtracting the weight of the grain we get the weight of straw. The plat stakes go on the wagon with the bundles from their respective plats, and follow the crop to the bag, where the plat numbers are transferred to tags wired to the bags in which the grain is placed. We used the so-called wired tag, never tying with the tag string, but fastening the tag permanently into the side of the bag. Samples of the grain from every plat are saved for future notes in case the whole is not preserved. Our rather dry climate makes our results in ripe straw and grain fairly accurate without determining water-free substance, and doubtless our averages would be little changed by drying, and the added expense would be considerable.

Our methods of getting the yields of cereal forage crops are much the same, while we are only now experimenting on methods of getting at the acreage yields or capacities of different kinds of pastures. Ample storage capacity in buildings is an essential for seeds and for grain in bulk, and in moister climates than ours it is doubtless economy, or, in some cases, necessary, to have large storage capacity for nearly all unthrashed crops from plats. But facilities for at once thrashing, without piling up and subjecting to mistakes, mixing, and destruction by vermin, are of far greater importance. A seed house should have many small compartments, some small and some large bins, a seed-cleaning room, and, in our climate of moist, cool autumns, a room in which seed corn and other seeds needing it may be dried by artificial heat. This building, like every other around our experiment station, should have walls made vermin-proof by a liberal use of brick and mortar and wire cloth in the angles between walls and between floors and walls, and at many of the openings, such as ventilators. As a rule, such buildings should be well ventilated, and should be separate from stables and general grain bins and storage bays for fodders, as nothing makes our reports of plat work more unreliable than unevenness in stand and vigor of plants, caused by unevenness in vitality and vigor of seeds. Where practicable, seeds of our own preserving should be used in preference to the too often unreliable seeds procured from seedsmen or from farmers.

Chemical and physical laboratory control work are very profitable in connection with field experiments.

Several plats annually, if properly planned and managed in each of the Western States, would return to our farmers a very fine percentage on their cost, as much experimenting on farms would be saved. Let us not think less of bugs and tuberculosis, nor of compounding chemical manures, and balanced rations, but more; and let us get ourselves into a mood for greater respect for experimenting out in the fields. We have had but little schooling in field experimenting in our colleges. Many of our agriculturists are obliged to start into work in States where they are little acquainted with the agriculture of the various parts of their States, and, by the time they have learned the State, they are called up higher by some institution, or are called down by some trouble, possibly more or less political in its nature. That State is fortunate whose agricultural college and station combined is making for her a number of practical experimenters; to insure that, in the future, she has competent work done in teaching and experimenting with the part of our work which must be learned by experience in the State.

While I venture to give below something of a classification of plat experiments, it is most wise to confine the work to only those lines of greatest moment in each State, unless funds are ample for experiments along many lines, as a few things done to a finish are very valuable, and many things but poorly done are simply opportunities wasted.

Under the subject of raising each class of crops, many practical things can be reduced to scientific form, which the farmer does as his father did, with but little knowledge of its philosophy or of its business outcome, and too often in a manner to get very poor results. How to apply barn and commercial manures is little understood in the West, and there are a thousand and one questions regarding how best to plant each crop on each soil in every State, and the only way the farmers will ever know the facts is through scientific experiments.

Applying water under irrigation is a most interesting line in which our Western agriculturists are working, and which we further East must study. But a question touching a far wider scope of country and of far greater monetary importance is the conservation, in our soils, of the water from rains and snows, and getting from it the greatest net value. The preparation of the soil and intercultural tillage in reference to controlling soil moisture have come to be most prominent questions in the middle Northwest, where we recently have occasional droughts.

Methods of harvesting and preserving crops offer quite as honorable lines for experimenting as do the study of clover nodules or the antennæ of insects, though too few of our new college graduates have set their sentiments in that direction. Methods of raising crops have been improved mainly through the efforts of machine men, who, under our most beneficent patent laws, profit by studying the raising of crops, and the sale of machines adapted to improve the crops or to save labor.

Next to methods of raising crops, the testing of varieties has progressed. The newly appointed agriculturist too often bases his fond hopes for undying fame and transcendent glory on this class of work. But it is a necessary and most important line of our work in every State, and not without considerable credit, as in case of our good friend, William Saunders, of Ottawa, Canada, and his grains, or of Professor Blount, or Dr. Hillgard, and the numerous field crops sent out over their States. It is necessary to test, in every State, the most promising varieties of each class of crop which may be procured within and without the State, discarding, as soon as possible, all but the comparatively few best, that the most of our energies may be expended upon the promising sorts. When the best are decided on, they may so cheaply be improved by breeding them, that the State which does not provide for this work is neglecting an opportunity of being of great assistance to her farmers. If pansies can be bred into so many beautiful varieties, and if Europeans can raise the percentage of sugar in the juice of sugar beets from 6 to 15 per cent in a little over half a century, I have the strongest faith that we can add 10 to 30 per cent to the yield of Minnesota's famous No. 1 hard wheat, which is not a very large yielder. In this work we reduce the size of plat to 1 foot square and deal with individual plants, each under the same conditions as is every other, as would the breeder of dairy cows or the breeder of trotting horses, and our record yields, or, if you please, performance records, are becoming far more numerous and quite as interesting as are the performance records of milkers and trotters.

From one kernel of wheat, oats, barley, field peas, or timothy, selected because of its inherited tendency to yield a large crop of grain, and used as a basis of variety, we can have enough grains for a twentieth-acre field test in three to five years. These newly originated varieties must be tested in a field way in comparison with the standard sorts most generally used in the State. All but the best old and new sorts can be rapidly eliminated, else the work will become bulky. It would seem practicable to raise a hundred bushels of each new, excellent variety of wheat, for example, on our own lands. Furnish this seed to a farmer who has good land, clean of weeds, and have him grow it for us at a slight premium over ordinary market prices; then we can have the farmer deliver the one or more thousand bushels to the freight companies, bagged, and bill it to farmers to whom we sell it in quantities of, say, 5 bushels or less, at cost of seed and packages. Thus we can inject into the State annually one or more varieties of a superior grain, the farmers paying all of the expense except the experimenting to find or improve the kind. Varieties which endure, proving their value to farmers and millers when put to practical test, will be very rapidly spread. Some plat work may be needed in seed control to prevent seedsmen from sending into the State varieties that are not profitable. So many of the best yielding varieties and subvarieties have no identifying features, and if we do not increase and distribute the original stock with which our best yields were made, we do the State little or no good—maybe harm.

Some of our best-yielding Fife wheats, for example, which have a performance record of male and female parents for several generations and have averaged best in a dozen plat trials, may look like other Fife wheats. We must distribute it to perpetuate our work of breeding it up.

In general field management, such as rotation experiments, the management of meadows and pastures, etc., plans have developed slowest and are yet crudest. Which agriculturist here could give us a statement of the best rotation for a dairy farm, a sheep farm, or a farm devoted to diversified agriculture, in the different parts of his State, and sustain his position with carefully collected facts? We do not know which crops to collect in the rotation, nor in what order of succession to place them. We have only very dim ideas of which crop best prepares the land for each other crop. We have very crude knowledge of which rotation gives the farmer the largest net average annual profit above cost of production. We have not made a study of which rotation best keeps the weed and insect enemies at a minimum. We have done too little at calculating the ultimate result on the fertility of each way of managing the rotations on the field or farm. Nor have we the facts or figures with which to emphasize the importance of live stock and the raising of those crops which will be turned into manure on the farms rather than shipped away.

Those responsible for experiments on plats need to study methods more and to consult with each other more on methods of this kind of research, and to spend more time in laying out the scheme of their own experiment work.

A brief discussion of both papers followed.

It was moved by Mr. Armsby that the section recommend to the Association that Mr. Hilgard's paper entitled "The Distribution of Salts in Alkali Soils" be read before the general session. Carried.

The third subject, "Shall the results secured in dairy tests be stated as butter fat or its equivalent in butter? The adoption of a conversion factor" was next taken up. The discussion was opened by Mr. Armsby, who was followed by Messrs. Cooke, Curtiss, and others. After the discussion, Mr. Armsby presented the following resolution:

Resolved, That the section recommends that in tests of cows or herds by fat tests the results be stated in terms of butter fat and also in terms of its approximate equivalent in butter.

The resolution was carried.

Mr. C. F. Curtiss moved that the section recommend the adoption of a conversion factor of 16⅔ in converting butter fat into butter. This was amended by Mr. W. W. Cooke, who moved to refer the question of adopting a conversion factor to a committee of three, said committee to report to the section at the next session, on the 17th. The amendment was accepted and the motion carried. The chair appointed as such committee Messrs. Curtiss, Armsby, and Cooke.

Mr. Armsby next addressed the section on the subject, "A practicum in stock feeding," in which he detailed his method of giving practical instruction in stock feeding to dairy students. The section then adjourned.

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The section was again called to order by the chairman. The committee on conversion factor reported through its chairman, Mr. Curtiss, the report being in favor of adopting the factor of 16⅔ in converting butter fat into butter.

On motion of Mr. Myers the report was accepted and adopted.

Mr. J. H. Connell next presented a paper on "Practical Methods of Maintaining Fertility," which was followed by a spirited discussion in which many delegates took part.

The chairman appointed the following committee on nominations: Messrs. C. D. Smith, J. L. Hills, and A. A. Mills.

Mr. Smith next read a paper entitled, "Individuality as a Prime Factor in Experiment Station Feeding." The subject was illustrated by charts showing the remarkable variation in yield of milk and butter fat to which individuals are subject. He was followed by Mr. Cooke, who spoke on "Objects and Methods of Experimenting on Dairy Feeding," and Mr. Mills followed with a paper on "Length of Periods in Experiment Station Feeding." These papers created much interest and developed a discussion in which many of the delegates took part.

Mr. Armsby addressed the convention on the subject of "Digestion experiments." He showed some apparatus used and explained his methods of procedure. Mr. Hilgard next presented the following paper, which was illustrated by charts showing the results obtained by different reagents on many samples of soils:

LATE PROGRESS IN SOIL ANALYSIS.

The revival of interest in direct soil examination for practical purposes is fast bearing its fruits in the development of new methods of analysis, as well as of modes of interpretation of the results obtained by former methods; and this movement is no less pronounced in Europe than in the United States. The great difficulty experienced in the practical carrying out of culture experiments to definite conclusions under any but the most rigorous scientific supervision is becoming more and more obvious; and so is, correspondingly, the desirabilty of direct methods for determining the needs of a soil without losing at least one year's time in culture experiments.

In the discussion of this subject it is too often forgotten that two distinct questions call for solution by chemical soil analysis. One is to ascertain the total store of plant food which may become available by the weathering process within periods of time in which we are interested, involving essentially the durability of the land. The other is the ascertainment of the plant food immediately available for the growth of crops. The former aims to determine a maximum; the latter, a minimum. Much fruitless discussion has arisen from a confounding of the two problems, which clearly can not be reached directly by the same means. The determination of immediately available plant food interests specially the agriculturists of countries long settled; while those intending to settle on new lands of unknown cultural values are specially interested in knowing how long it will be before the soil they cultivate will call for fertilization, and when it does, what fertilizers will be needed first. It is still further desired by them to know what are the special adaptations of their lands; and while these are as much determined by physical as by chemical factors, yet a knowledge of the latter is indespensable to an intelligent judgment.

It is hardly necessary at this stage of the discussion to do more than to recapitulate briefly the points that chemical soil analysis as usually practiced can fairly claim to have established, in respect to its direct bearing on cultural experience, before discussing those that as yet have not been fully tested.

(1) As regards soils in their natural condition there can be no question that an unusually small proportion of any one ingredient important to plant nutrition indicates that a deficiency in that ingredient will make itself felt, if not at once certainly within a few years after cultivation is begun, and can be remedied by the use of that ingredient as a fertilizer.

As a corollary to this, those who claim that analysis can not appreciate the differences caused by the withdrawal of soil ingredients by crop production must admit that the same maxim holds true of soils cultivated in crops definitely known for any length of time without the addition of any fertilizers. This brings a very large proportion of American lands now under cultivation within the pale of those which can be successfully investigated, and therefore practically benefited, by the lights afforded by soil analysis.

(2) Conversely, any ingredient shown by analysis to be present in very large proportion in any virgin soil may fairly be presumed to be the last to become deficient under ordinary modes of cultivation.

Both the above propositions not only commend themselves to common sense, but have been over and again abundantly verified in practice. Conjointly they point the way to a third, viz, that as between soils of essentially similar nature or origin the amount of plant food which is made currently available by the various processes of "weathering" is sensibly proportional to the relative amounts present and shown (or presumed to be shown) in the analysis.

It seems to me that as regards these simple propositions, the burden of proof rests with those who deny them; always provided that the analyses have not been made by too incisive a method, and upon an absolutely uniform plan. The ultimate analysis of the soil mass (by hydrofluoric acid or by carbonate fusion) is to all intents and purposes practically worthless; while on the other hand too light an action, such as that of carbonated water, is equally valueless in presence of the fact that plants themselves have long been known to employ as solvents acids exuded from their roots, sometimes of sufficient strength to engrave the form of the root fibers upon the smooth surface of feldspar and hornblende crystals in the course of a single season.

The practical utility of the interpretation of soil analyses depends essentially, of course, upon the correct ascertainment of the percentage and relative figures which may be considered as constituting deficiency, adequacy, and abundance of any ingredient. To this I have devoted a great deal of labor, the results of which, so far as then developed, I have given in former publications. It was but reasonable to expect that the figures for the several degrees of deficiency or abundance would not be the same for soils of every class, and I so found it, the most potent determining factor in the premises being lime, actually or virtually, in the form of carbonate.[1] The general statement made by me fourteen years ago, that in the presence of abundance of lime much smaller percentages of plant food prove adequate than when lime is deficient, is abundantly verified by all the work done since, whether by myself or others; but the causes, according to modern research on bacterial action, are shown to be even more complex than I had foreseen at the time of my former publications. In the course of a closer personal study of the soils of Europe I have also recognized one reason at least why this dominant function of lime has remained almost unrecognized in the Old Continent. This is simply that calcareous formations (including the drift areas) are so predominant in Europe that few soils are what can properly be called noncalcareous; that is, not containing at all times a sufficient excess of calcic carbonate to produce the characteristic important effects upon the soil. With us such large areas are deficient in lime in the soil that the contrast between them and the adjacent calcareous areas becomes patent at a glance. It was this that in the first place led me to consider the claims of soil analysis as worthy of consideration. Added to this accident of the almost uniformly calcareous character of European soils comes the fact that only such as had been long cultivated came under the consideration of investigators there, who thus wrestled with the problem in its most complex form. This explains very simply the discredit which was there so long thrown upon the very name of soil analysis, a tradition to which some persons on this side of the Atlantic still tenaciously cling, while on the other side that tradition already counts among the "*ueberwundene Standpunkte,*" and the effort to make soil analysis useful to practice is being zealously pursued by many hands.

The most notable recent utterance on the general subject is that of Professor Liebscher, of Göttingen, in a report of 216 pages on the results of a seven years' course of culture-plat experiments. He shows the necessity of discussing all such results on the principles of the calculus of probabilities, and by so doing comes to a number of very valuable conclusions regarding the particular soils on which the experiments were made. Further than this the results of course can not go; but Liebscher wisely accompanied his plat experiments with parallel analyses of the several soils, using the usual method of chlorhydric extraction. Regarding these he makes at the end of his report the following statement, remarkable as coming from a notable authority who has thus far never said a word in favor of chemical soil work.

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[1] Wheeler and Hartwell (Rhode Island Sta. Bul. 28) aver that I was in error in the statements made regarding the "commanding position of lime" in a paper quoted by them, in which the above proviso regarding the carbonate was not made. My meaning is, however, so plainly put in several other publications that I can not admit their claim to be well founded, and the facts shown by themselves as the results of liming but corroborate my maxim.

"While reserving detailed discussion for the future, we can not omit to mention right now that the ordinary analysis of the chlorhydric soil extract yields much more information than is mostly supposed. In fact, we can deduce the requirements as to mineral plant food of all the soils we have investigated, from their analysis, coming to the same results as from our culture tests, by adopting the following points of view in their interpretation."

These points of view agree so closely with those heretofore developed by me in my work on virgin soils that I can not but feel considerable satisfaction in seeing them verified for soils long cultivated, a point regarding which I have not expressed any opinion thus far, although convinced that such agreement would, in the nature of the case, be found to exist. Soil analysis thus becomes a most valuable guide and adjunct for culture tests, abridging the latter and eliminating their uncertainties to an extent that only long-protracted series of blind trials could otherwise achieve. Of course, the final test will always rest with culture experiments, but these can, under the lights afforded by a reasonable knowledge of the soil's peculiarities, be undertaken by the farmer on a large scale with a vastly smaller chance of costly failures. It is almost entirely upon such experience—had partly before, partly after examination—that my interpretation and conclusions as to the efficacy of this method of investigation is based.

Coming now to the second problem, numerous efforts to ascertain the condition of the soil with respect to immediately available plant food have, as is well known, been made, but have yielded very indefinite results until within the last few years. Dyer attacked the problem by the direct determination of the acidity of the root juices employed by the plant in dissolving its mineral food. When once mooted, the wonder is that this simple, direct appeal to the plant itself had not been thought of sooner, since it has long been evident that this action is much more energetic than that of carbonated water, at first thought to be the chief solvent.

Warington[1] has discussed the imperfections in Dyer's prescription of a 1 per cent solution of citric acid as a solvent for the supposed available mineral plant food. Most of these have been foreseen and admitted by Dyer himself, who is still, it is understood, engaged in the investigation of the subject. One of the most serious obstacles to the ready use of Dyer's method, especially in the West, is the presence of earth carbonates, which of course neutralize the citric acid used to an extent corresponding to the amounts present, which it is not altogether easy to neutralize without risk of increasing unduly the solvent effect, since it is inadmissible to use either heat or a stronger solution to accelerate the decomposition of the carbonates. The only really unobjectionable way seems to be the successive addition of the 1 per cent solution until neutralization ceases, then adding the required amount of the acid in addition. This is often a tedious operation, especially when the carbonate grains are somewhat large; and thus the use of the method in limestone soils is somewhat inconvenient.

I have, however, tested it on a number of soils containing only small amounts of carbonates, for the determination of the available phosphoric acid, with results agreeing exceedingly well with the cultural experience. In the absence of suitable material for such experiments in as new a State as California, where moreover nearly all soils are calcareous as a reult of climatic conditions, I have used a number of soils sent from the Hawaiian Islands for investigation as to their needs, they having ceased to produce satisfactory crops of sugar cane.

Most of the soils of the Hawaiian group are the outcome of the decomposition of black, highly ferruginous lavas, under the influence of rather copious rains. The soils so formed are usually of a deep ocherous tint, unless (as is frequently the case) they contain humus enough to obscure the iron tint, which, however, appears plainly on ignition. They would fall under the very indefinite class of "laterite" soils of German authors; but, unlike a great many of the true tropical laterites, the iron is in this case so apparent, not merely because of fine diffusion, but on account of its extraordinary amount, which sometimes exceeds 40 per cent of ferric oxid, and is usually in the thirties; while the alumina dissolved in the ordinary chlorhydric extraction is frequently only one-third as much as the ferric oxid, though sometimes equal, and frequently far exeeds the carbonate-soluble silica, proving its existence in the form of hydrate. While mostly supplied fairly with potash, many of these soils are characterized by very small lime percentages, in view of which I have long ago recommended the use of the coral sand from the beaches, with excellent results.

Nearly all these soils showed by extraction with nitric acid after ignition ample and in some cases very large percentages of phosphoric acid. As in several cases the use of phosphates had nevertheless produced good results, I suspected that the phosphoric acid might be rendered unavailable by the presence of so large an excess of ferric oxid—a relation I had previously observed in Mississippi soils, and which is readily intelligible a priori. It is strenuously reaffirmed by Liebscher, who in his recent publication, referred to above, mentions specially that the presence of the sesquioxids seems to depress seriously the availability of the phosphoric acid of the soil, because of the insolubility of their basic phosphates in the dilute vegetable acids of the roots.

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[1] Science Progress, May, 1894.

As these Hawaiian soils seemed to offer an exceptionally good opportunity for testing this question, the determination by nitric acid in the ignited soil was supplemented by one made with chlorhydric. This treatment, as might be anticipated, gave a very much larger result in most of the samples, since crystalline vivianite will dissolve in HCl as well as the gelatinous basic ferric phosphate, for which reason I have discarded its use in the determination of phosphoric acid for the practical purposes of soil analysis. The same objection lies, of course, against the use of concentrated sulphuric acid, proposed by Goss. In either case, the results are simply obscured by the mass of inert matter brought into solution.

The table on page 92 exhibits these results, together with those obtained on some California soils. Among the latter is one (No. 1117) notably deficient in phosphoric acid, both from the analysis and from culture tests, while the rest are all from fresh, if not virgin, ground and stand in no present need of fertilization, judging from their profuse productiveness.

Keeping in mind that such figures as 6 and 8 in the third decimal place mean a deficiency of available phosphoric acid according to Dyer's results, the lesson taught by the figures in this table explains itself. In the highly productive virgin soils of California the citric-soluble phosphoric acid has ranged from 0.033 to as much as 0.063, while in the "phosphate-hungry" soil No. 1117, 0.006, or from one-fifth to one-tenth as much only appears. In the case of the Hawaiian soils the showing is equally cogent; of those from the Oahu plantation, Nos. 1 and 2 were reported as giving poor crops with the same amounts of phosphates that gave a satisfactory crop on No. 3, which contains four times as much of the easily soluble form. Nos. 1 and 3, from the Hawaii plantation, do not as yet show a very serious decrease in crop production, but it was desired to know where trouble was likely to arise. Here the phosphates are probably not concerned as yet; and I was led to investigate specially the cause of the deficient production in the case of No. 6, which bore two fair crops and then utterly refused to grow the cane to maturity.

I suspected that, notwithstanding the high humus percentage of this soil, there might be a deficiency of available nitrogen, and therefore applied to it the clew previously obtained from the investigation of the nitrogen percentages in the soils of the arid and humid regions,[1] which pointed to the much greater ease with which humus of high nitrogen percentages can be nitrified in the soil. Conversely, it was predicable that whenever that percentage falls below a certain point, nitrification will be too slow to supply the needs of a growing crop.

While I have not yet been able to verify this induction to the full extent required, all the data thus far obtained corroborate its correctness. A few such data are given in the table. Among the California soils the most striking example is that of No. 1679, one of those showing an unusually high nitrogen percentage in its humus (18.6 per cent). Alongside of it the long-cultivated soil, taken within 50 feet of the other sample, but kept in grass, unmanured, for about ten years, and lately dug up because of unsatisfactory growth of the grass, shows with a higher humus percentage a much lower proportion of nitrogen, proving strikingly the depletion caused by exhaustive cropping. A similar relation is shown between the two old soils of the Oahu plantation and the relatively fresh one (No. 3), where the ratio is as 1 to 3. Of the soils from the Hawaii plantation, the first two (4 and 5) are just a little below the Oahu soils in the nitrogen percentage of the humus, although the totals of both humus and nitrogen in the whole soil are higher. But in the case of No. 6, while the humus percentage is nearly double that of the other two, the nitrogen content of that humus is the lowest I have yet observed—1.7 only. In order to test the hypothesis in this striking case, I made the pot-culture experiment. Unfortunately, the experiment could not be carried to its conclusion, on account of the invasion of the leaves by the *Puccinia graminis*, which, despite of vigorous sulphuring finally killed the plants. It will be repeated with special precautions against the recurrence of this trouble. But even as the experiment stands, the correctness of the induction in this case can not well be called in question. I expect before long to hear of the results of the same test on the large scale, for which the same dose of Chile saltpeter (about 165 pounds per acre) was recommended.

I think, therefore, that I am justified in indulging the hope that we are on the trail of a method for the definite ascertainment of the condition of a soil as to available (nonnitric) nitrogen, which, with the method of Dyer for the corresponding determinations with respect to potash and phosphoric acid, when all are perfected, will effectually solve the problem of the manure requirements of cultivated soils that has so long resisted the efforts of chemists. There can be no doubt that differ-

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[1] Agl. Sci., April, 1894.

Table of analyses of some California and Hawaiian Islands soils.

	California soils.							Hawaiian Islands soils.					
								Oahu.			Hawaii.		
	No. 110, Putah Valley, middle land, Dixon, Solano County.	No. 168, valley soil, Santa Paula, Ventura County.	No. 1167, black lands soil, 3 miles west of Tulare City, Tulare County.	No. 1117, granite soil, Fleming tract, Amador County.	No. 1281, reddish gray mesa soil, experiment station, Chino, Los Angeles County.	No. 1679, black adobe soil, University of California grounds, Berkeley, Alameda County.	Long-cultivated soil, University of California, Berkeley.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Coarse materials > 0.5^mm	All.	3.50	10.60	50.00	10.00	15.00		2.00	2.00	2.50	4.00	3.00	5.00
Fine earth		96.50	89.40	50.00	90.00	85.00		98.00	98.00	97.50	96.00	97.00	95.00
Analysis of fine earth.													
Insoluble matter	67.33	85.66	62.43	77.11	67.98	54.50		16.60	15.84	14.49	26.99	28.66	21.07
Soluble silica	3.67	1.85	16.99	5.40	9.51	19.00		14.37	14.07	30.37	10.26	7.35	2.68
Potash (K_2O)	.93	.63	1.09	.35	.93	.73		.66	.45	.26	.40	.61	.44
Soda (Na_2O)	.12	.07	.77	.17	.42	.20		.09	.14	.08	.26	.17	.25
Lime (CaO)	.77	.76	1.46	.37	1.75	1.15		.56	.26	1.04	.52	.68	.28
Magnesia (MgO)	2.29	.59	1.44	.37	.82	1.08		.76	.65	.80	.96	1.04	.60
Brown oxid of manganese (Mn_3O_4)	.11	.03	.06	.09	.05	.04		.04	.05	.03	.21	.20	.07
Peroxid of iron (Fe_2O_3)	8.01	3.35	4.98	2.93	7.07	8.43		40.00	39.05	19.68	19.10	18.23	30.10
Alumina (Al_2O_3)	9.16	3.10	6.87	7.27	7.72	7.92		12.64	14.61	18.29	21.41	20.18	14.38
Phosphoric acid (HNO_3, sp. gr. 1.20)	.11	.20	.12	.04	.20	.19		.16	.19	.32	.64	.70	.97
Phosphoric acid (HCl, sp. gr. 1.115)								.32	.43	.35	1.60	1.28	
Phosphoric acid (citric acid, 2 per cent solution)	.040	.062	.062	.006	.054	.033		.004	.004	.020	.035	.037	.025
Sulphuric acid (SO_3)	.12	.01	.02	.02	.03	.04		.04	.03	.09	.32	.21	.29
Water and organic matter	7.12	3.13	4.36	6.09	3.49	6.54		14.30	14.18	14.59	18.60	21.65	28.60
Total	99.94	99.38	100.59	100.22	99.97	99.82		100.22	99.52	100.04	99.67	99.61	99.73
Humus	1.71	.84	1.33	.80	.58	1.20	1.65	3.33	3.35	3.24	4.84	5.43	9.95
Humus ash			.36	.31	.26	.94		3.90	3.12	2.22	2.76	3.56	6.70
Containing phosphoric acid			.01	.02	.02	.04		.074	.11	.166	.58	.50	
Containing silica								.650	.78	1.100	.76	.84	
Humus nitrogen in 100 humus	4.250	7.990	18.190	15.270	15.500	18.580	3.40	3.55	3.30	9.800	2.80	3.100	1.71
Humus nitrogen in 100 fine earth	.072	.067	.302	.123	.090	.203	.056	.118	.110	.314	.134	.168	.170
Hygroscopic moisture absorbed at 15° C	10.32	5.49	5.38	3.27	1.98	11.98		19.66	18.50	21.25	23.07	23.140	23.81

ences in the other soil ingredients will influence the lower limits of each of the three primarily important substances; more especially will the presence or absence of an adequate amount of lime to keep the soil in nonacid condition, and to perform the many other important functions of that base, doubtless be found very important. I have long ago published, as the result of numerous comparisons of soil composition with agricultural practice, that in presence of much lime a smaller percentage of the several mineral ingredients will be found adequate. From the data already obtained, the same seems to hold true in respect to nitrogen. That this is likely to be so might be predicted from the well-known favorable effect of lime on nitrification, and my figures appear to indicate as probable that in soils poorly supplied with lime the limit of "nitrogen hungriness" lies rather above 2.5 per cent of nitrogen in the soil humus, while in calcareous soils it lies below that figure for grass crops on soils otherwise fairly conditioned.

It is predicable that no definite figure can be assigned that would be valid for all crops and soil conditions. The richness of the humus in nitrogen is but one of the several factors that contribute to ready nitrification; porosity and temperature as well as moisture conditions will make their influence felt, and it is thus probable that in relatively cold, close soils, and in cold climates a higher nitrogen content is required for ease of nitrification than where warmth and porosity concur in favoring the action of the nitrifying bacteria. Again, different crops will require a different rate of nitrogen supply. Here, as in the rest of the problem of predicting the qualities of soils, no mechanical or mere sliding scale requiring no effort of the intellect or judgment will be likely to suffice, but a number of points will have to be conjointly considered. Admitting all these difficulties, it will be no inconsiderable advantage to find in this method an approximation to the problem of a soil's requirement in nitrogen, as we have in Dyer's method an extremely useful index of the soils needs in respect to potash and phosphoric acid. While in all cases the plat or field test will have the last word, yet the simplification and directness introduced into them by the previous determination of the prominent features of the soil by chemical means is so great and palpable an advantage, and so clearly in line with the recognized methods of inductive investigation in all other lines, that its omission is hardly excusable.

After the discussion of this subject, a motion was put and carried to the effect that the section ask permission of the executive committee to hold a session at 2 p. m. the 18th, for the discussion of the subject of irrigation. The committee on nominations made the following report: For chairman, C. C. Georgeson; vice-chairman, C. F. Curtiss; secretary, H. J. Patterson.

The report was accepted and referred to the general session for confirmation.

Adjourned.

THURSDAY, *July 18, 2 p. m.*

The necessary permission having been obtained from the executive committee, the session again met pursuant to resolution for the discussion of the subject of irrigation. The subject was opened with an address by L. C. Carpenter. His address was followed by speeches from several other delegates and the discussion was continued until 4 p. m., when the section adjourned sine die.

THE SECTION ON HORTICULTURE AND BOTANY.

In the absence of the chairman, the meeting was called to order July 16, 1895, by Mr. Lazenby, secretary; and Mr. Burrill was elected chairman pro tempore.

A committee, consisting of Messrs. L. H. Pammel, P. H. Mell, and F. W. Rane, was appointed to select papers from the published programme for presentation at the general sessions. After consultation, the following papers were selected:

(1) "The Bacterial Flora of Foremilk," by H. L. Bolley.
(2) "How Shall We Teach Horticulture?" by William R. Lazenby.
(3) "Some Undefined Duties of Station Horticulturists," by F. W. Rane.
(4) "The Grass Problem of the Plains," by C. E. Bessey.

An interesting and suggestive letter from L. H. Bailey on a new method of work in horticulture was read by the secretary and elicited considerable discussion.

Section held its second meeting Wednesday afternoon, July 17.

The following resolution, offered by Mr. Pammel, was unanimously adopted:

Resolved, That the Section on Horticulture and Botany deem the organization of a new section on "irrigation" ill-advised and uncalled for.

The following papers were then presented:

"Soil Moisture as Influenced by Local Factors," by F. W. Card. "The Relation of the Systematic to the Economic Botanical Work of the Station," by Aven Nelson. "The Necessity of a Fuller Consideration of the Nonlocal Conditions in Botanical Investigation," by H. L. Bolley. "A New Spraying Apparatus," by E. S. Goff. "Bacteriological Methods and Bacteriological Work," by L. H. Pammel. "Results Reached in Crossing," by J. L. Budd.

The section held its last session Tuesday afternoon, July 18.

The first business in order was the election of officers for the ensuing year. This resulted as follows: Chairman, F. W. Card; secretary, H. L. Bolley.

A motion was made by Mr. Lazenby and duly carried, that a committee of three be appointed to report at the next meeting of this Association a carefully formulated scale of points to be used as a standard in the judging of orchard and garden fruits.

The committee appointed was: William R. Lazenby, E. S. Goff, and L. H. Bailey.

Mr. Mell offered the following, which was unanimously adopted:

Resolved, That the secretary of the Section on Horticulture and Botany be instructed to correspond with the horticulturists and botanists of the Association asking them respectively to select two horticultural and two botanical subjects of general interest to the section, for consideration at the next annual meeting. These four subjects to be selected as soon after the adjournment of the present session as practicable and that due information of the topics selected be given. The selection of the four topics to be made by the chairman and secretary of the section from the lists submitted.

The following papers were then presented:

"The Forage Problem in the West," by J. W. Toumey; and "Methods of Studying Parasitic Fungi," by G. F. Atkinson.

At the request of the members, the secretary then read the following papers, the authors being absent:

"Soil Treatment for Fungus Diseases in Connection with Crop Rotation," by B. D. Halsted. "Is Variety Testing of Sufficient Importance to Justify its Cost," by S. A. Beach. "The Value of Fruit Tests in Different Localities," by M. H. Beckwith.

The hour for the excursion tendered by the Denver Chamber of Commerce having arrived, the section adjourned.

THE SECTION ON ENTOMOLOGY.

The meeting was called to order at 2 p. m. July 16, 1895, by Chairman Gillette. In the absence of the secretary elect, Mr. Lawrence Bruner was appointed temporarily to this position.

The first paper presented was that prepared by T. A. Williams, entitled "Plant Lice of the Chrysanthemum." In his absence the secretary did the reading.

In this paper Mr. Williams described two new species of these insects, one a green and the other a brown form. As remedies he suggested the use of kerosene emulsion. In the general discussion that followed, the facts were brought out that the green species was quite readily controlled by the ordinary methods employed by florists. Not so, however, with the dark-colored species. Professor Smith had found the fumes of bisulphid of carbon to be about the only remedy for it. The method employed was to place the infected plant in some tight box or vessel in which an open dish of the bisulphid was also confined. Mr. Bruner had also noted the difference in the hardiness of the two forms, but had not made any experiments tending to their suppression. Mr. Atkinson suggested the possible use of the fungus Sporotrichum as a possible remedy, mentioning as an example of the effectiveness of this disease a case where ants in the laboratories of his college had succumbed to it. Several other references to kindred diseases were cited by those present.

A second paper by the same gentleman followed. It was entitled "A New Sawfly on Plum." The insect in question was a very common and destructive one in various parts of the Dakotas, Nebraska, and adjoining States. Its preference seemed to be the native or wild plums, but cultivated varieties did not escape. The insect is gregarious, and spins a web, draws the terminal foliage of twigs together, and feeds while protected. Paris green was suggested as a remedy. Messrs. Bruner, Gillette, and Cockerell had each seen the insect and were quite well acquainted with its mode of attack, all having had more or less experience with it or some allied species.

Mr. Waldron, at this stage of the meeting, asked the opinions of those present as to the cause for the almost total absence of the Colorado potato beetle from much of the central region of the United States. The same immunity had been noticed by Messrs. Smith, Toumey, and Gillette, but none of these gentlemen had thought much about the matter, hence could suggest no definite reasons for such a decrease in the insect's ranks.

Following this a general discussion arose concerning insecticides and insectifuges. Especial stress was laid on a certain insect lime that had been distributed to various experiment stations for trial. No very strong recommendations were given it by those who had tried it. It was thought that it might possibly be used to advantage if applied against such tree insects as cankerworms, etc. The material appeared to be some kind of petroleum refuse, similar to a crude vaseline, hence should not be expensive—a requisite for an insecticide or insectifuge for general use.

Mr. Hillman reported the appearance of *Pieris rapæ* in the vicinity of Reno, Nev. This brought up a general discussion concerning remedies that can be applied for this and other cabbage worms.

Mr. Cockerell read a paper entitled "The Entomologists' Platform," in which he urged the desirability of the entomologists writing in a more definite manner to further those reforms concerning which they were all agreed. The work of the station entomologist consisted first, of investigation, and second, of spreading the truths ascertained among the people. The latter was really missionary work, and could only be carried on successfully by united effort. Although there were entomological associations, the points of agreement among their members were too little emphasized, while the public was very ready to observe and comment on the disagreements which occurred. Yet, if the entomologists could get the agricultural and horticultural public to do only those things they could unanimously recommend, the gain would be immense.

In the discussion which followed, the matter of "technical" or strictly scientific papers arose, and it appeared to be the sense of most of those present that such papers should only be published by stations as bulletins under certain conditions, and that these papers had best be sent to scientific periodicals, transactions or proceedings of scientific societies.

Mr. Atkinson exhibited certain enlarged "Choke cherries," which resembled more or less closely the "Plum pockets," so frequently seen on various cherry and plum trees. These particular specimens were infested by a Cecidomyid larva in large numbers, and the question that arose was, "Do the Cecidomyid larvæ cause the deformity in the cherries, or is this deformity caused by some fungus, and later visited by the female fly for an egg repository?" Mr. Bruner had often seen the insects within the abnormally large and oddly formed fruits. None of the insects had been reared by him. Mr. Atkinson had found the fungus upon larva-inhabited fruits.

Adjourned till Wednesday, July 17, at 2 p. m.

Second session called to order by President Gillette.

The first paper read was one entitled, "Some Observations on the Plum Tree Gall Mite," by A. D. Hopkins. Some of the results obtained by Mr. Hopkins in his experiments with this mite were a surprise to those who heard this paper read. Sulphur did not appear to destroy the mites when used in the ordinary manner, neither did kerosene emulsion kill them when applied as strong as one part of the emulsion to two parts of water. A general discussion was then had in reference to remedies against mites.

A second paper from Mr. Hopkins was read, "On the Study of Forest Tree Insects."

A paper was then presented by Mr. Gillette, entitled "Two Leaf Rollers." These leaf rollers are two of Colorado's worst pests on fruit and box elder trees, and are specially abundant near the foothills from Fort Collins and Greeley on the north to Colorado Springs on the south. The moths which lay the eggs are abundant about the trees in the evening at this time of the year, where they congregate to lay their eggs. The moths are small, yellowish in color, and deposit their eggs on the trunks and large branches, where they lie dormant until next spring. As the worms are now through with their feeding we shall not be troubled any more with the pest this year.

Professor Gillette has been experimenting largely for the destruction of these pests, and finds that they may be destroyed either in the egg or worm state. In the egg the most successful remedies were a very strong kerosene emulsion applied during the winter, or an application of ordinary whitewash just before the eggs hatch or about the time the buds of the trees begin to open. The best remedy for the destruction of the worms was Paris green in water, applied in the proportion of 1 pound to 75 gallons of water, about 2 pounds of lime being added to prevent the burning of the leaves. The first application should be made as soon as the rolling of the leaves is noticeable, and the application should be repeated once in two weeks as long as needed. An interesting fact in connection with the destruction of these pests is that a bacterial disease has appeared at Fort Collins that has destroyed the worms in large numbers.

Mr. Cockerell then exhibited to the section a number of very interesting Coccidæ from different parts of the world, among which were typical specimens of some of the most destructive species.

The officers for the ensuing year were then elected as follows: Otto Lugger, chairman; G. C. Davis, secretary.

Adjourned sine die.

THE SECTION ON MECHANIC ARTS.

The first meeting of the Section on Mechanic Arts was called to order July 16 by Chairman Patterson. After the reading of the minutes of the 1894 convention, the section entered into a general discussion, relative to the recognition of the Section on Mechanic Arts, in the name of the Association.

The discussion brought out very forcibly that the Section on Mechanic Arts is not supported by the general Association, and in order to induce prominent educators in mechanical lines to take an active interest in the work of the section, some recognition must be given to mechanic arts in the name of the Association, inasmuch as agriculture is specifically recognized.

The regular work of the meeting was then taken up. A paper submitted by Lieut. W. H. P. Creighton was read by the secretary.

Lieutenant Creighton's paper was enthusiastically discussed, and Mr. Paul indorsed graphical methods in all educational, as well as in mathematical and technical work.

The secretary read a paper, by O. P. Hood, entitled "Engineering in an Agricultural College," which opened up a general discussion on "What courses shall we carry on in our colleges?"

The following committee on nominations was appointed: Messrs. Lawrence, Colburn, and Carpenter.

The meeting adjourned to meet July 17, 1895, at 2 p. m.

The adjourned meeting of the Section on Mechanic Arts was called to order at 2 p. m. July 17, 1895, by Chairman Patterson.

Mr. L. C. Colburn was called upon and presented a paper, full of interest and practical suggestions, on the "Theoretical *v.* Practical Work of an Engineering Course."

Mr. C. V. Kerr not being present, the subject of his paper, "Training of Negroes in Arkansas," was informally discussed by Messrs. Langford, Hill, Patterson, McCrea, Dickinson, Colburn, and J. W. Lawrence.

Hon. Frank A. Hill outlined in an interesting manner successful methods that had been employed in the education of the Indian.

The committee on nominations submitted the following report:

> Your committee on nominations desires to present the following names for the officers for the ensuing year: Chairman, J. W. Lawrence; vice-chairman, S. Fortier; secretary, F. P. Anderson.

Report accepted and adopted.

The meeting then adjourned sine die.

THE SECTION ON COLLEGE WORK.

Section met pursuant to programme at 2 p. m. July 16, and was called to order by Mr. Goodell, of the executive committee, in the absence of Chairman Connell. The secretary, H. H. Wing, being absent, C. D. Smith was elected secretary pro tempore.

It was resolved that the topics, "What studies should be embraced in the four-year Bachelor of Science course" and "How can the usefulness of agricultural and mechanical colleges to the masses be increased" be presented in the general session on the morning session of July 17.

Mr. Murkland, chairman of the committee appointed in 1894 to consider the requirements for admission to agricultural and mechanical colleges, reported that the subject was being thoroughly investigated by a committee of another organization, and that they deemed it inexpedient to parallel that work.

A paper was then presented by C. D. Smith on "What Constitutes a Practical Agricultural Education."

After discussion of the subject by Mr. Clute and others as to the position of the short course in college work, the section adjourned to 10 p. m. July 16.

The section met at the appointed time, Chairman Connell presiding.

Mr. C. C. Georgeson presented the topic "Agricultural Education in Denmark" in an extemporaneous address, of which an abstract follows:

The scheme of agricultural education in Denmark presents some features, a study of which may be of value to us in America. In one essential particular it differs diametrically from ours. There the attempt is not made to give the student a liberal education. Here, any boy with a willingness to work can find an opportunity to educate himself in the arts and sciences. In Denmark such culture is not so readily obtainable. In that country attendance upon the common school is made compulsory, but the number in agricultural pursuits that take a higher or collegiate course is relatively small. The agricultural education is therefore strictly technical and goes straight to the point. The Royal Danish Agricultural Society is over a hundred years old. Its object is to disseminate a knowledge of agriculture among the farmers. It gives to young, promising farmers' sons an opportunity to acquire technical agricultural education by making arrangements with prominent farmers to take a certain number of pupils on their farms for purposes of instruction.

There are in Denmark about 20 private agricultural schools and 100 high schools in which the sciences related to agriculture are taught. Pupils may go to these schools either before or after they have taken the work on the large farms.

The Royal Agricultural College is the only institution of college grade devoted to agriculture in Denmark. There are from 300 to 400 students in attendance. No literary culture is attempted. The curriculum includes three principal branches, veterinary, medicine and anatomy; agriculture and horticulture, and forestry.

The agricultural work includes instruction in mathematics, botany, chemistry, physics, zootechnique. The instruction is thorough. The college is open for the entire year. Two and three year courses are provided, but no degree is granted. No farm is connected with the institution, but the students either have been on one of the large farms for practical work or will go to one after leaving college. The students expect to become farmers, therefore the college work is all aimed in that direction. High-school training is required to enter the Royal Agricultural College.

The section then adjourned to meet at 2 p. m. July 18.

The section met at the time mentioned.

It was moved and carried that the following gentlemen be recommended to the general session for officers of the section: Chairman, A. A. Johnson; vice-chairman, J. E. Stubbs; secretary, Eugene Davenport.

A paper was read by T. B. Comstock, of Arizona, on "How Can the Usefulness of the Agricultural and Mechanical Colleges to the Masses be Increased," and another by Mr. Myers on the same subject.

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